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What's next for mobile: 6 areas to watch in 2017

The primacy of mobile in our age is evident. Ubiquitous and necessary, mobile is fundamental to how we live today. It shapes the way we communicate and interact with much of the world, permeating to an astonishing degree our daily commerce with business and relationships with one another. Mobile also serves as a central element for funneling the most innovative, cutting-edge technologies of our time.

And mobile innovations are spreading far beyond the smartphone, extending to—and disrupting—new categories and other industries: virtual reality, automotive, home automation, smart cities will all build on mobile foundations. Evolving technologies, such as artificial intelligence and low-power cellular technology, will propel mobile even more deeply into an ever-expanding universe of devices, experiences, apps, services and content. To this end, players of all stripes—manufacturers, content and service providers, developers, advertisers—will keep advancing mobile-centric strategies to bind consumers and businesses to an increasingly rich and complex ecosystem.

In this white paper, we in the Technology group at IHS Markit share insight into what lies ahead for the vast and continually exciting world of mobile, touching on six core areas that we believe will have vital resonance in the days to come.

1 Mobile platforms and apps

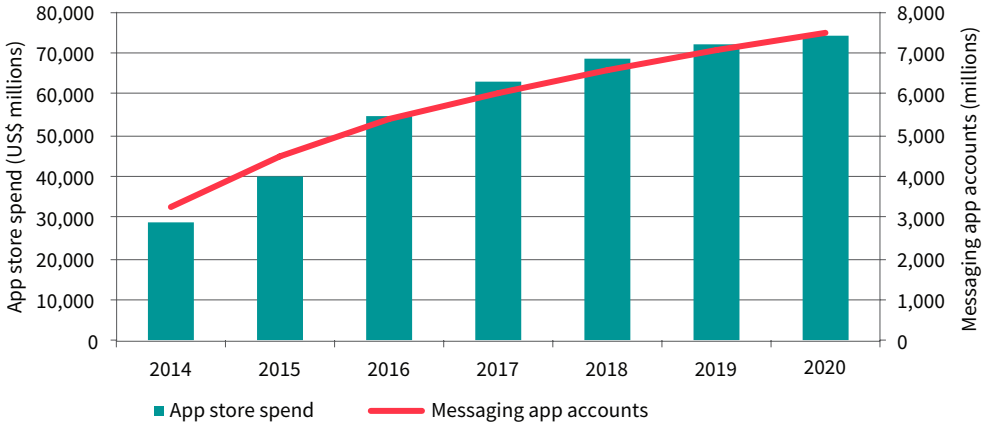
Mobile app spending will keep growing. Platform strategies will fuel mobile competition and innovation.

- Consumer spending on mobile apps will reach $74 billion in 2020, up from $54 billion in 2016 – IHS Markit forecast.
- Major companies are increasingly trying to use the fast-maturing mobile apps and services market as part of a wider platform strategy to tie consumers into ecosystems.
- Such a strategy covers a broad range of consumer devices and services including apps, payments, communications, content and devices.
- Messaging apps were early pioneers of the platform shift. Asian leaders WeChat, Kakao and LINE have since evolved from simple messaging to offering payments, ticketing and booking, games, advertising and various other features now being adopted by Western counterparts.

Messaging app platforms will continue to expand.

- Free and low-cost messaging apps once proved disruptive to traditional telco business models. Now their transition to providing wider platforms threatens further upheaval. OTT messaging apps boasted an aggregate audience of more than 5 billion active user accounts at the end of 2016, which will grow to almost 7.5 billion by 2020.
- The reach of a company's platform—comprising addressable users, devices, services and partnerships—will be crucial to enabling new artificial intelligence (AI)-powered experiences.

Global mobile app store spend and active messaging app accounts



Source: IHS Markit

Key IHS Markit analysts at MWC: Jack Kent, Ruomeng Wang

Payment services are crucial for platform monetization.

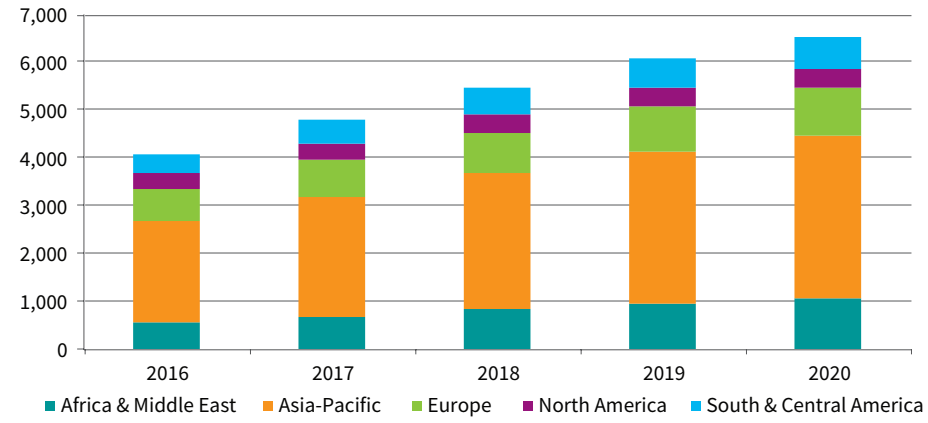
- Integrating messaging, payments, content and commerce is critical to platform monetization.
- Bringing payments and messaging services together helps maintain app engagement, drives in-app sales and potentially increases the value, effectiveness and transparency of advertising and marketing campaigns.
- The number of addressable smartphones for device-based payment services—e.g., Apple Pay, Android Pay, Samsung Pay—will rise to more than 5 billion units by 2020, up from 2.7 billion in 2016 – IHS Markit forecast.
- Over-the-top (OTT) and app-based platforms will also grow their payment ambitions: companies including PayPal, Tencent (WeChat) and Facebook will be competing in the same space.

2 Smartphones

Smartphone usage will keep expanding.

- The global smartphone installed base will exceed 6 billion units by 2020, up from 4 billion in 2016.
- Revenue for smartphones shipped in 2020 will total $355 billion.
- To sell smartphones, device makers must persuade consumers to upgrade from the current smartphone they use.
- Smartphone innovation will continue to spread across industries, with smartphone makers diversifying.

Global smartphone installed base by region (millions)



Source: IHS Markit

Differentiation through hardware will become even more difficult.

- The camera and display are the principal ways smartphone makers have tried to spur smartphone market growth and innovation in recent years.
- Smartphones with larger screens over 5 inches are the new normal, but the size of smartphones will reduce. In Q3 2016, 81% of the launched devices tracked in the IHS Handset Specification database had a screen of 5 inches or larger, up from 73% a year ago. The focus now is to squeeze big displays into smaller frames by decreasing both bezel size and dead real estate around displays.
- This trend will be driven initially by high-end device makers, with cheaper devices for their part likely to feature larger borders around the screen.
- Dual cameras will become more commonplace, and original equipment manufacturers (OEMs) will shift to software as a differentiator.

AI and software investments will make smartphones smarter.

- Software investments and partnerships are critical for hardware companies to create smarter AI-enabled experiences.
- Vendors including Google, Apple, Sony, Microsoft and Samsung have developed their own AI and voice-assistant capabilities. Companies with less in-house software expertise —lacking the scale of users or resources to invest in their own solutions—should look for partners rather than compete.

- As Amazon's Alexa makes its way onto other devices, Google must expand the reach of its own Assistant to all Android smartphones—reducing the differentiation for Google's Pixel smartphone.
- AI will begin to impact the user experience more than ever. Existing capabilities from Siri and Google Now will expand, enhanced by proprietary developments.

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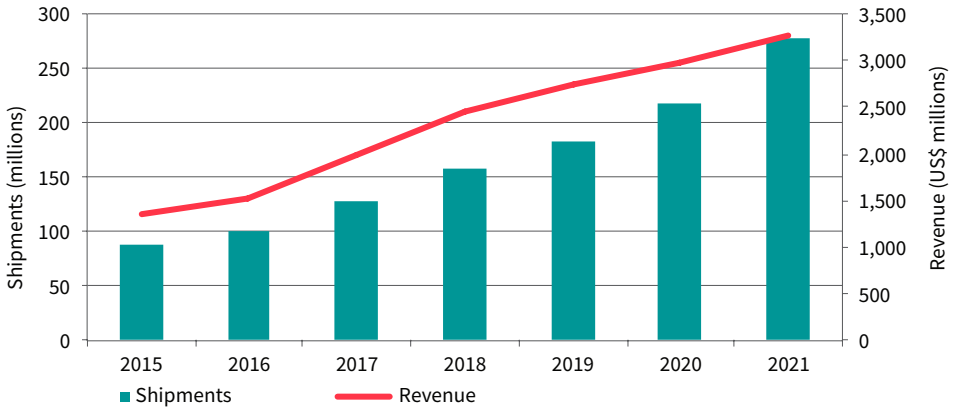
3 Cellular IoT and 5G

Cellular technology gets optimized for IoT.

- Cellular technology is becoming more optimized for Internet of Things (IoT) application requirements.
- While cellular technology was designed for mobile voice subscriber needs, smartphone innovations led by the original Apple iPhone in 2007 have enabled cellular technology to increasingly support ever-faster mobile broadband speeds.
- Mobile handsets with 4G technology will account for 73.8% of shipments in 2020, up from 55.5% in 2016.

Global M2M module shipments and revenue



Source: IHS Markit

Revenue models, however, have not matched technology developments.

- Traditional subscriber-oriented cellular technology and revenue models have not been well-suited for typical IoT use cases. Examples: Cellular-connected IoT devices did not possess long-enough battery life, or could not be placed in challenging locations such as underground or in basements. Components were too expensive, or monthly connectivity fees too high, to enable positive business cases.
- Even so, the mobile ecosystem has made great strides in adapting traditional cellular technology to new use cases—reducing component costs, for instance. The cost of 2G (GPRS) cellular embedded modules fell to $6.40 in 2016, down from $19.40 in 2010.

Low-power, low-cost innovations will become more common as 5G is deployed.

- In the face of a mature and saturating traditional mobile subscriber market, the mobile industry has embraced the IoT as a new growth opportunity.
- Significant technical innovation is now occurring to create a better fit between cellular technology and IoT application needs.

- This is happening today in light of LTE-Advanced enhancements, including the new low-cost low-power wide area (LPWA) specifications for the likes of LTE-M and narrow-band (NB)-IoT. Innovation will become even more pronounced as 5G is deployed into the market.
- Shipments of NB-IoT modules (LTE Cat-NB1) will exceed 84 million units in 2021, up from just slightly over 1 million in 2017.

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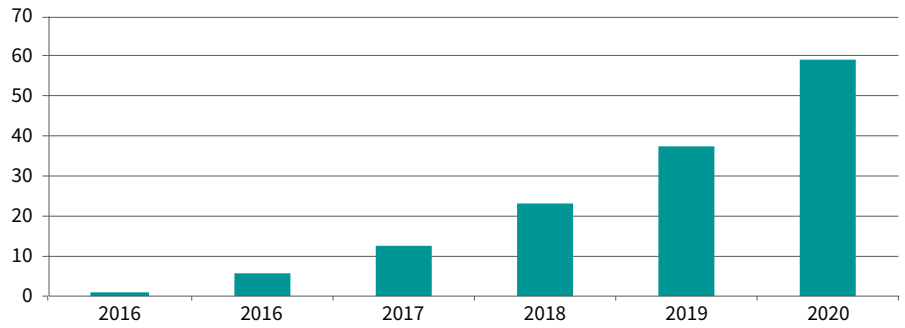
4 Artificial intelligence and voice assistants

The smart speaker market will expand greatly.

- The global smart speaker installed base will exceed 59 million units by 2020, up from 6 million in 2016.
- Nearly half of all multiroom speakers shipping in 2020 are expected to feature smart functionality.

Global smart speaker installed base (millions)



Source: IHS Markit

Opening up to third-party developers will drive momentum.

- Competition in smart speakers and voice assistants will intensify in late 2017 and 2018.
- With Google's recent release of Actions on Google and its Embedded Google Assistant software development kit, more third-party products and integrations will appear at the end of 2017.
- Much like it took more than a year for Amazon's release of the Alexa Skills Kit to generate momentum for Echo, it will take time for Google's virtual assistant platform to take off. But the cycle will be quicker so that Google Assistant could span the whole Google ecosystem more rapidly.
- Mobile approaches can differ. Apple opened its Siri voice assistant to third-party developers in 2016, but support remains limited to a few predefined actions, such as payments, booking, communications and fitness. Apple may need to increase third-party support as voice assistants become more prevalent and capable across multiple devices. In comparison, Google Assistant was available only for its Pixel phones at launch, but the expansion of Amazon's Alexa to other devices will likely spur Google to proliferate more quickly.

Smart speaker prices will fall as assistant platforms extend reach to other devices.

- The price of smart speakers is likely to drop steadily. Platform suppliers that provide companies with turnkey platforms for multiroom audio and virtual assistant support will streamline development time and cost. This year will see a number of inexpensive Alexa-based options, with the same taking place for Google Assistant in 2018.

- Expect to see multiple virtual assistants emerge, as the market is still quite young. Alexa is the current torch-bearer thanks to good timing, but other players—including manufacturers of third-party smart speakers, the purveyors of far-field voice recognition technology, home audio manufacturers and other players—remain relatively agnostic, with no stakeholder tying fortunes to Alexa alone.
- Most companies plan strategically to support multiple virtual assistants in order to maximize the total available market (TAM). Currently on the horizon is Google Assistant, with potentially Siri and Cortana included depending on their launch plans and scale.

Google Assistant will replace Google Now.

- Google Assistant will gather momentum, gradually replacing in the next couple of years Google Now/Google Voice Search across Google's connected platforms.
- Google Assistant will roll out first to Android TV, platform-wide, via a version update. On mobile platforms, the rollout is expected to expand beyond Assistant's current exclusivity to the Pixel.
- Android Auto will also be a future target.

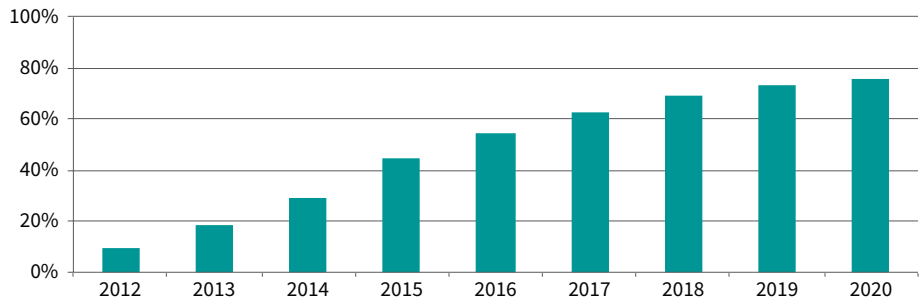
Key IHS Markit analysts at MWC: Paul Erickson, Jack Kent, Ian Fogg

5 Advertising

Mobile advertising will continue growing in scope and influence.

- Global mobile advertising surged 71.9% in 2015 compared to the previous year, and accounted for 44.6% of all online advertising revenue.
- Worldwide mobile advertising grew 42.4% in 2016, and for the first time generated more than half—54.8%—of all online advertising revenue.

Global share of mobile in display advertising revenue (%)



Source: IHS Markit

Advertisers continue to become savvier in mobile.

- As traffic shifts to mobile, online and mobile budgets are coming not only from mobile-only advertisers, but also and increasingly from larger brands.
- Advertisers today are gaining fluency in online and mobile advertising, as well in creating digital teams with mobile experts. While still working with ad agencies on media plans, companies like Walmart, Target and Netflix now have in-house digital and mobile advertising teams that make their own decisions on which firms to partner with and on what formats best address their audience.
- As large brands become more adept, mobile app developers and publishers will have to adapt their offerings and capabilities to serve these advertisers.

Mobile is going "native."

- Mobile advertising has grown stronger than any other medium in the last four years, and now accounts for a significant proportion of online advertising revenue.
- By 2020, over three-quarters of all online display advertising revenue will come from mobile.

No universal pricing and measurement are available, as yet.

- As with all new online ad formats, measuring the return on investment (ROI) from native advertising is still a challenge.
- There is no single attribution system for brand- and performance-based advertisers to understand how their ads perform, which is forcing advertisers and publishers to assess ad spend on a campaign-by-campaign basis.
- This will require a degree of experimentation with measurement in the initial stages of implementation. However, as native gains scale, standards—even if not codified by national trade associations—will be adopted.

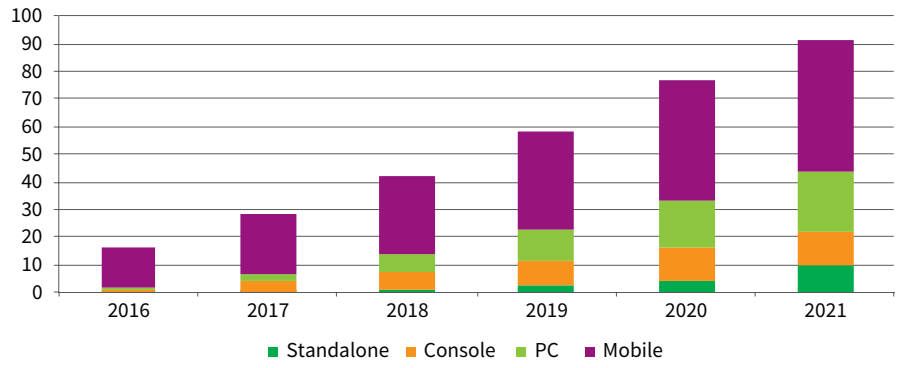
Key IHS Markit analysts at MWC: Daniel Knapp

6 Virtual Reality

Mobile devices drive mainstream VR adoption, but growth here—although springing from a larger base—will be slower than in standalone, PC and console solutions.

- The total consumer VR headset installed base will rise to more than 90 million by 2021, up from 16 million in 2016—IHS Markit forecast.
- Mobile VR will remain the largest category in VR headsets.
- Mobile's share will decline to 50% over the next five years, down from the 90% range in 2016, as more advanced standalone, PC and console-based headsets provide superior and longer-lasting experiences.

Global consumer VR headset installed base by device type (millions)



Source: IHS Markit

Mobile headsets will realize much lower content monetization.

- While mobile headsets will make up the majority of the VR installed base, IHS expects that the relatively inexpensive nature of the devices—often bundled with new smartphones alongside a more limited content experience—will lead to lower content revenues when compared to content monetization derived from more advanced platforms.

- Mobile VR headsets can take advantage of the scale of app store content development, payment support and distribution. For developers, however, the VR opportunity is still relatively small when compared with scale of the smartphone installed base. Most of the money in VR for developers is currently from work-for-hire for brands or platform holders. Developers looking to publish directly struggle for profitability.

VR entertainment will surpass $3 billion.

- Games will dominate VR content spending, representing by 2020 more than 85% of entertainment spend and reaching $3.3 billion.
- Despite this rapid growth, VR entertainment spend will account for less than 1% of global entertainment expenditures.

China's VR market will follow its own path.

- Just as Google and Facebook's absence from China's mobile market helped drive the development there of a unique local mobile content and services ecosystem, the same will be true for the VR market in China.
- Already among the world's most dynamic VR markets, China will see local vendors and content distributors dominating the country's VR landscape.
- China is also leading the way for out-of-home, venue-based VR. IHS Markit estimates that there are over 8,000 venues in China in which consumers pay to play VR.
- VR arcades and experience venues are set to multiply in Japan, the US and the UK in 2017.

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