

AR/VR Market Review



AR/VR Revenue

AR/VR has become a two speed market, with mobile AR set to have over twice the installed base at launch in 2017 than the entire AR/VR headset market by 2021.

Apple ARKit, Google ARCore and Facebook Camera Effects platforms could have 900 million installed base by the end of 2018, with their launch changing the trajectory of the whole market.

Digi-Capital's Report has fundamentally revised the AR/VR market thesis, analysis and forecasts in its bellwether Augmented/Virtual Reality Report:

- Mobile AR dominates AR/VR for the foreseeable future;
- Smartglasses remain the long-term future of AR/VR, but could take into the next decade to become a mass-consumer market;
- VR's market potential has been diminished by the emergence of mobile AR as a rival platform;
- Premium VR might not accelerate until second-generation standalone premium VR headsets (neither PC nor mobile tethered, like the Oculus Santa Cruz prototype) break out in 2019/2020; and
- Mobile VR's potential has been reduced due to phone makers and developers pivoting towards mobile AR.
- The combined impact is a significant upgrade for AR and a material downgrade for VR. This completely replaces all previous forecasts.

The Virtual World Just Grows And Grows

Victormaxx offers new low-cost VR headset

In an attempt to beat the cost of other head-mounted displays (HMD), Victormaxx Technologies has released a VR headset called the Cybermaxx. Like other systems of its kind, the unit uses a real-time tracking system to allow users to immerse themselves in a 3D world — for only about \$700. Animation is smooth and fluid, and the system's response to movement is instantaneous. Several companies have already lined up to support the headset, including such big names as Origin Systems, Interplay, and New World Computing.

Unfortunately, the Cybermaxx has its share of problems. The unit latches to your head with a series of unwieldy straps that must be cinched tight in order to keep the headset secure. Couple this stress with the fact that some of the unit's weight sits on the bridge of the nose, and it's easy to see how the headset can get pretty uncomfortable during extended gameplay sessions.

In addition, Cybermaxx uses binocular-like tubes that press right up against your eyes to block out light. For users who have contacts, this pressure can cause those lenses to pop right out after only a few minutes of play. In fact, that's just what happened to our art director, Eddie Malstrom, when he tried out the Cybermaxx at CES.

Headsets like the Cybermaxx are sure to be the next big thing in peripherals. And as more companies compete to make their own headsets stand out from the crowd, two things must happen: The technology has got to improve, and prices will have to come down. For now, it looks like Victormaxx has the edge in that second area.

But while the Cybermaxx may offer the lowest priced unit so far, comfort must remain a consideration. Before you invest a large lump of cash on any headset, make sure you try it out for yourself. As we're beginning to see, not all of these things are created equal.



The Cybermaxx is the anticipated change of VR when it comes to price: at around \$700 it seems like a bargain. But there's one rule to live by, even in a Virtual World: You get what you pay for.

PC WEEK September 1994

AR/VR Revenue

Mobile AR's installed base could grow to over 3 billion by 2021, while smartglasses, premium VR and mobile VR combined might top 100 million in the same timeframe (so tens of millions for each platform individually).

This makes mobile AR's installed base more than 25x all AR/VR headsets long-term.

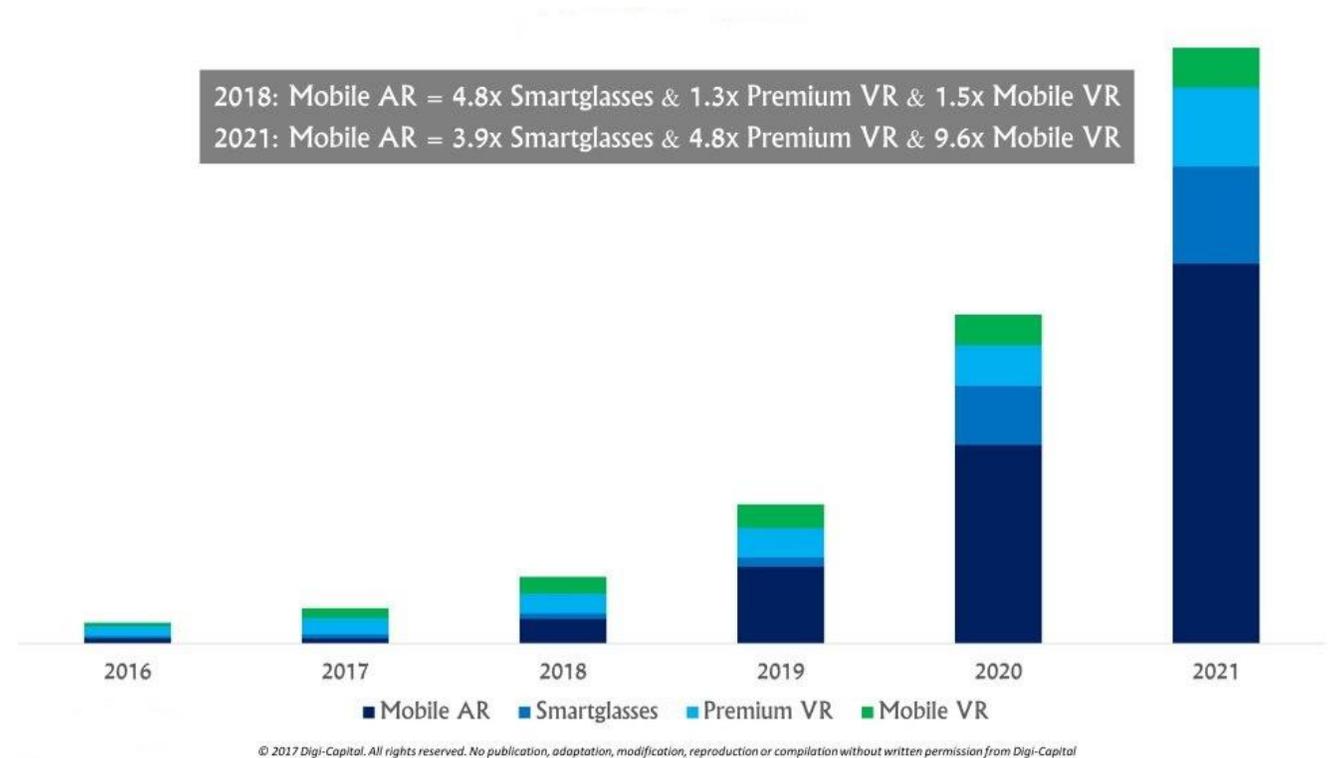
Where mobile AR dominates AR/VR installed base, it could account for only 2/3 of total market revenue by 2021.

Mobile AR software's economics are similar to the broader mobile market, where vast user bases with relatively low ARPU can deliver high growth and profitability.

Smartglasses, premium VR and (to a lesser extent) mobile VR benefit from significantly higher ARPU due to hardware sales, but much smaller installed bases limit their non-hardware revenue potential.

Mobile AR could deliver 4.8x smartglasses, 1.3x premium VR and 1.5x mobile VR revenue in 2018, growing to 3.9x smartglasses, 4.8x premium VR and 9.6x mobile VR revenue by 2021.

AR/VR Revenue 2016 - 2021



AR/VR Sector Revenue

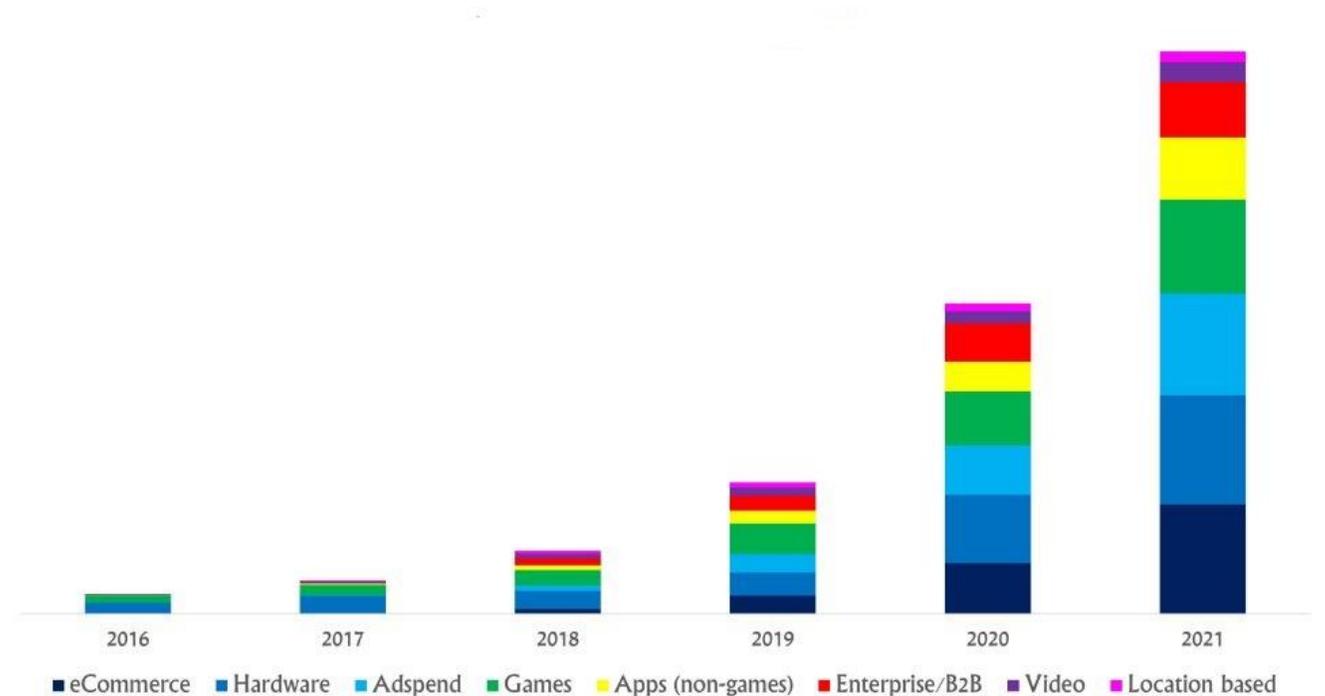
eCommerce could be the largest revenue stream across AR/VR by 2021 due to the scale of mobile AR's installed base and increased conversion rates.

Houzz has already delivered 11x sales conversion using mobile AR, so mobile AR eCommerce could further consolidate Amazon, eBay and Alibaba's dominant positions.

Hardware sales (particularly consumer smartglasses and second-generation standalone premium VR headsets) are a close second, followed by adspend, games and non-games app revenues.

Enterprise/B2B revenue will be driven primarily by AR, with video and location based (theme park) revenues at a much lower level.

AR/VR Sector Revenue 2016 - 2021



AR/VR Regional Revenue

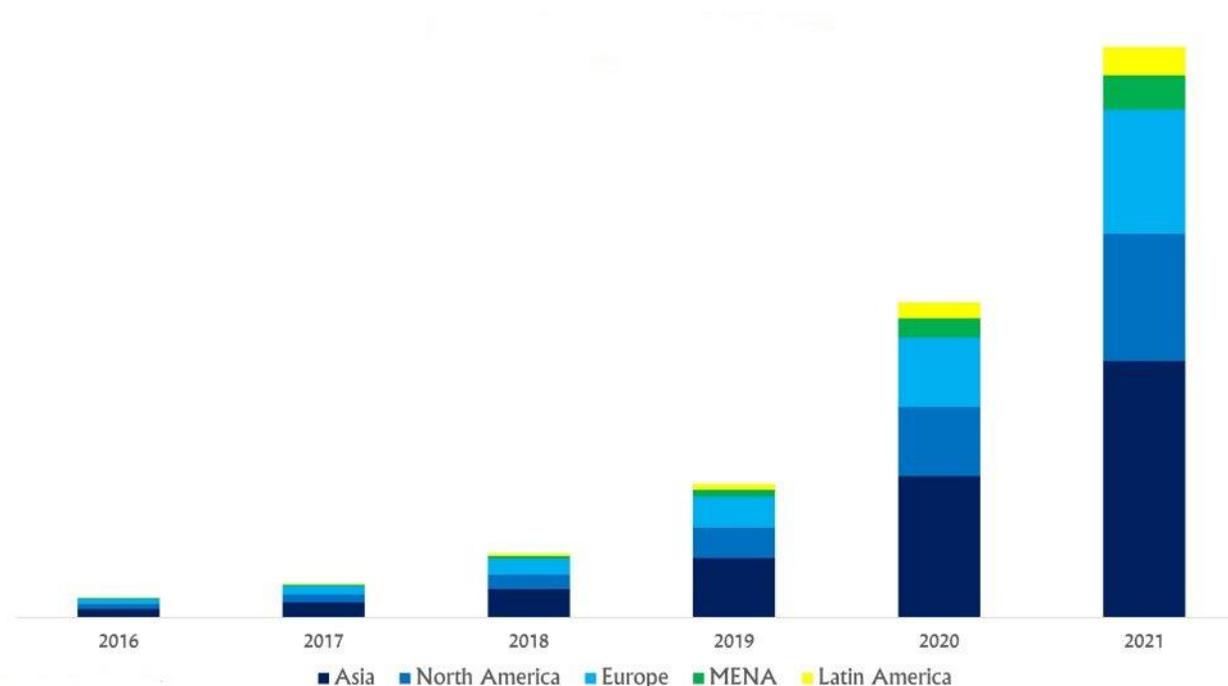
With mobile AR's geographic distribution broadly similar to current smartphone/tablet distribution, and VR's distribution broadly similar to current games market distribution, AR/VR revenue could be dominated by Asia (particularly China, Japan and South Korea). This could see Asia roughly equal in size to North America and Europe combined. As smartglasses early consumer growth could come from mobile tethered smartglasses, its revenues might follow a similar geographic pattern.

Because of consumer smartglasses five consumer challenges (hero device, all-day battery life, cellular connectivity, app ecosystem, telco cross-subsidization), predominantly enterprise focused smartglasses sales could remain in the hundreds of thousands of units through 2019.

Our long-held view since 2015 of Apple as the catalyst for AR proved to be correct this year. So its potential launch of mobile tethered smartglasses as an iPhone peripheral could be the catalyst for the consumer smartglasses market in the 2020 timeframe (followed by Samsung and other major phone makers).

Time to fire up that iPhone X and look into the future.

AR/VR Regional Revenue 2016 - 2021



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AR/VR Investments

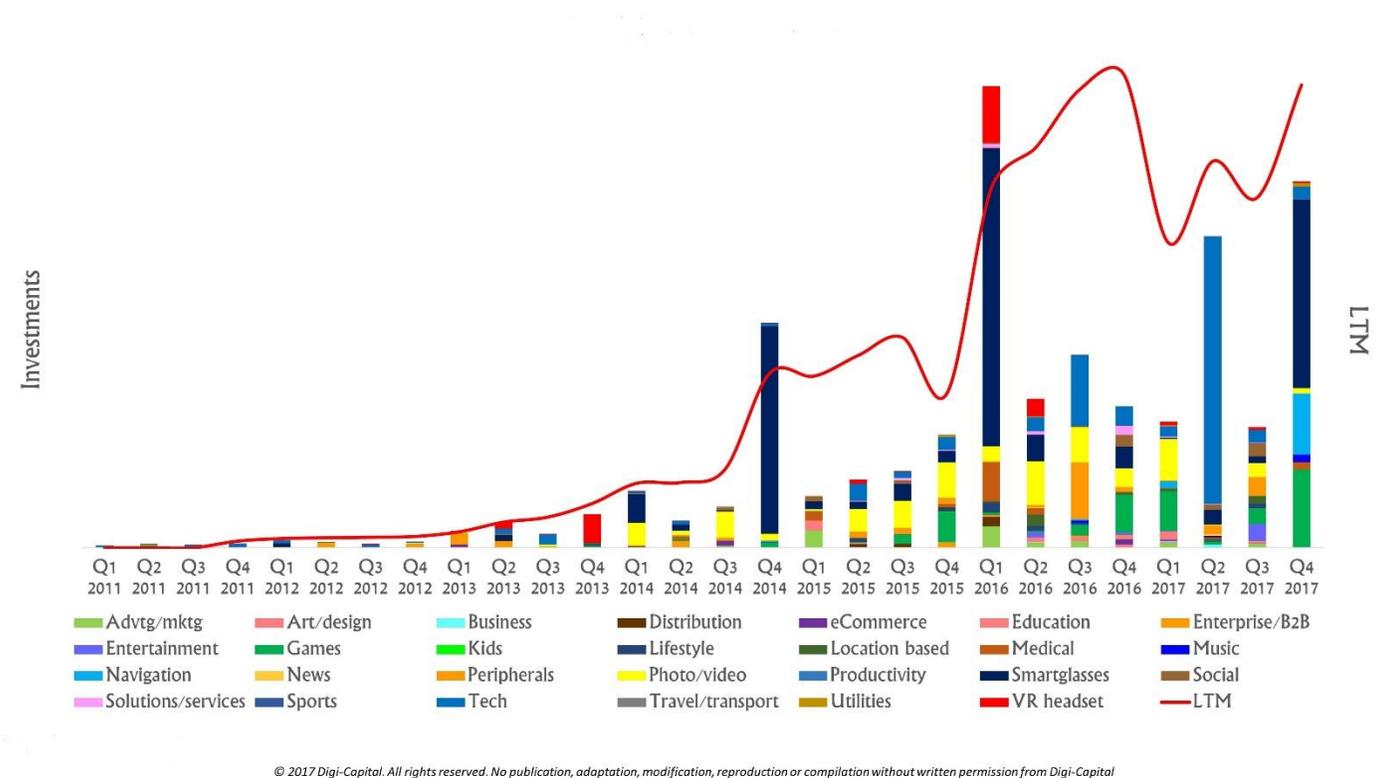
Startup leaders across the 27 AR/VR sectors in Digi-Capital's Augmented/Virtual Reality Report and Deals Database raised \$1 billion in the fourth quarter before the end of November.

This is only the second time the billion dollar figure has been reached in a single quarter. Three quarters of a billion dollars went into big deals like Magic Leap's \$502 million and Niantic's \$200 million, with VCs investing another quarter of a billion dollars into smaller rounds.

AR/VR startups have raised \$2.5 billion since the start of January 2017, equaling the record for AR/VR investment in a single 12 month period (with 5 weeks left to go in the year).

By sector, one third of all investment went into AR/VR tech since the start of the year. Just under a quarter of funds raised went into smartglasses, primarily because of Magic Leap. Games took more than \$1 of every \$10 raised, with AR/VR navigation, photo/video, peripherals, entertainment and social startups also raising significant amounts. The remainder of investment was spread more broadly across startups in AR/VR advertising, art/design, business, eCommerce, education, enterprise/B2B, lifestyle, location-based, medical, music, news, solutions/services, sports, travel/transport, utilities and VR headset sectors.

AR/VR Investments 2011-2017



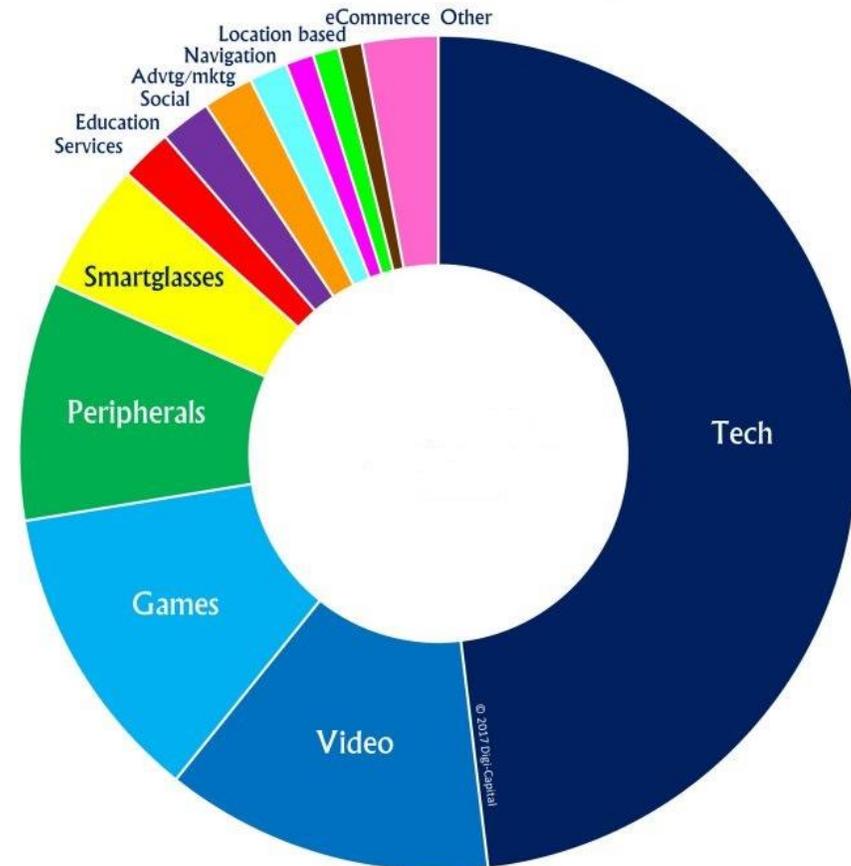
AR/VR Sector Investments

The now familiar pattern for AR/VR investment saw the highest volume of investments from pre-seed through Series A, with chunky later stage deals accounting for most of the dollar value in the quarter (Improbable over \$500 million, Unity \$400 million – reported as half investment and half secondary share sale by employees). However Facebook’s Camera Effects Platform and Apple ARKit for iOS (and potentially AR optimized iPhone 8 later this year) look set to recalibrate investor sentiment on the sector as a whole. That shift in thinking might take a little while to filter through to the mobile AR developer ecosystem as it spins up to speed, so watch this space.

Previous readers will notice that we’ve refined our sector analysis in the new report significantly, with more granular sector-by-sector detail and analysis of over 630 AR/VR companies and the hundreds of investors supporting them. One pattern remains constant for AR/VR Dealmakers, with half of all investment continuing to pour into core tech companies. The four other big investment sectors were video, games, peripherals and smartglasses, which together with tech account for just under 90% of all AR/VR investment.

Around \$1 of every \$10 was divided between solutions/services, education, social, advertising/marketing, navigation, location based, and eCommerce. The rest was spread across the smaller investment sectors of art/design, entertainment, business, lifestyle, music, enterprise/B2B, utilities, news, medical, sports, photo and distribution. Again as the impact of Facebook and Apple filters through the mobile AR startup ecosystem, an explosion of new app

AR/VR Sector Investments in 2017



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**) Actual Q2 2017*

AR/VR VCs Investors

<p>Advertising/marketing</p>	<p>Art/design</p>	<p>Business</p>	<p>Distribution</p>
<p>eCommerce</p>	<p>Education</p>	<p>Enterprise/B2B</p>	<p>Entertainment</p>
<p>Games</p>			
<p>Location based</p>	<p>Medical</p>	<p>Kids</p>	<p>Lifestyle</p>
<p>Location based</p>	<p>Medical</p>	<p>Music</p>	<p>Navigation</p>
<p>News</p>	<p>Peripherals</p>	<p>Photo/video</p>	
<p>Productivity</p>	<p>Smartglasses</p>	<p>Solutions/services</p>	
<p>Social</p>	<p>Sports</p>	<p>Tech</p>	
<p>Travel/transport</p>	<p>Utilities</p>	<p>VR headset</p>	

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*) Includes AR/VR startups investors from 2011 to 2017

Greatest hits of the best investors in tech globally

Alibaba, Warner Bros, Google,
Qualcomm, Fidelity, J.P. Morgan,
Morgan Stanley, T. Rowe Price,
Wellington, CIC, Intel, Amazon,
Fidelity, CITIC, NetEase,
Softbank, 21st Century Fox,
MGM, Lenovo, Tencent,
Comcast, Samsung, HTC

Sand Hill Road, Sequoia, DFJ,
Lightspeed, KPCB and Greylock
Colopl Next, The VR Fund,
Super Ventures, Signia Ventures,
Maven Ventures, Presence Capital,
GREE VR Capital, Boost VC, Anorak Ventures,
Outpost Capital, B Capital and others

AR/VR Investment Trends

The range of VCs investing into AR/VR startups went from small, early-stage specialist funds to global megafunds with billions under management.

While AR/VR is still a very early stage market, the emergence of mobile AR and more advanced computer vision/machine learning has brought a broader range of investors to the space.

The cooling of VC investment sentiment in VR earlier this year has now been counterbalanced by AR (particularly mobile AR) focused thinking.

ARKit, ARCore and Camera Effects could have 900 million installed base by the end of next year (over 3 billion by end of 2021), but it could still take mobile AR startups another 12 months to scale in revenue terms.

The early stage of the market means that VCs' typical 3 to 5 year time frame is about right for investments being made today, as we are still at the earliest stages of what the market could become. Long-term dominant players should emerge to cash in their golden augmented tickets, but that might not happen before 2019.



AR/VR Mergers and Acquisitions (M&A)

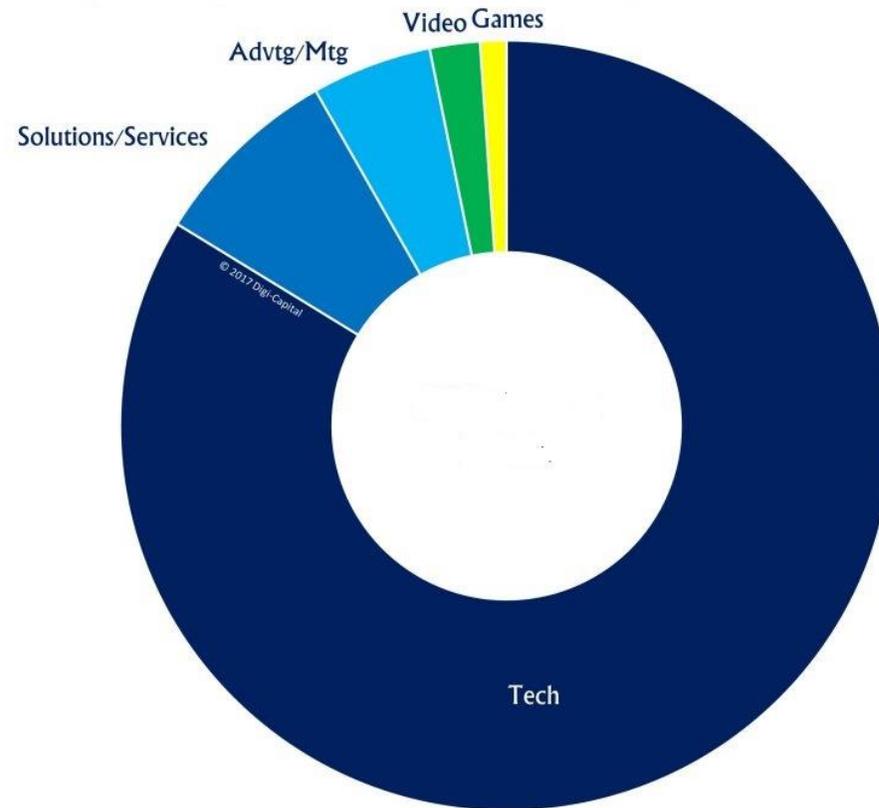
Despite Facebook's blockbuster \$3 billion Oculus acquisition in 2014, VR/AR has been too early stage for large scale mergers and acquisitions (M&A) so far. But that's set to change in the next 12 to 18 months, so let's look at what could drive M&A deals going forward.

Where Digi-Capital's Augmented/Virtual Reality Report Q1 2017 and deals database tracked \$1.5 billion investments in the last 12 months to Q1 2017, there was only \$600 million of M&As in the same period.

That dynamic of investments outstripping M&As is typical of early stage tech markets, when deal making is all about investment for growth rather than consolidation for dominance or cost.

However as the VR/AR market continues to scale, M&A deal flow is on the rise. Major corporates are actively honing their strategies on where and who to buy. Startups are also considering larger corporate parents to provide safe harbor, until the market is big enough for their business models to sing. And as often happens, early stage companies which can't raise the next round are looking for mergers with better funded startups to leverage their tech and talent.

AR/VR Sector M&A

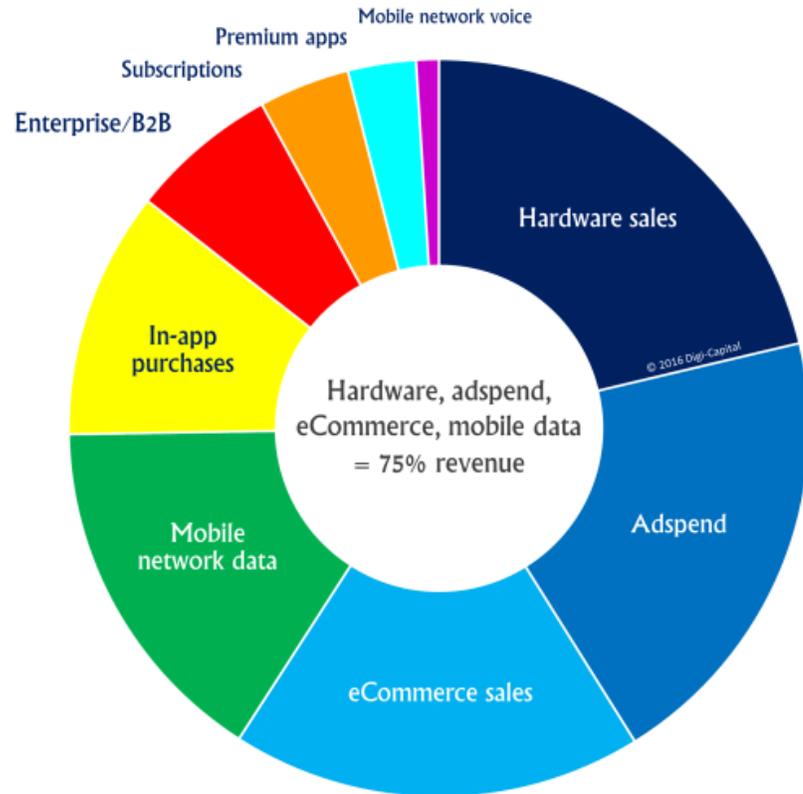


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**) Actual Q1 2017*

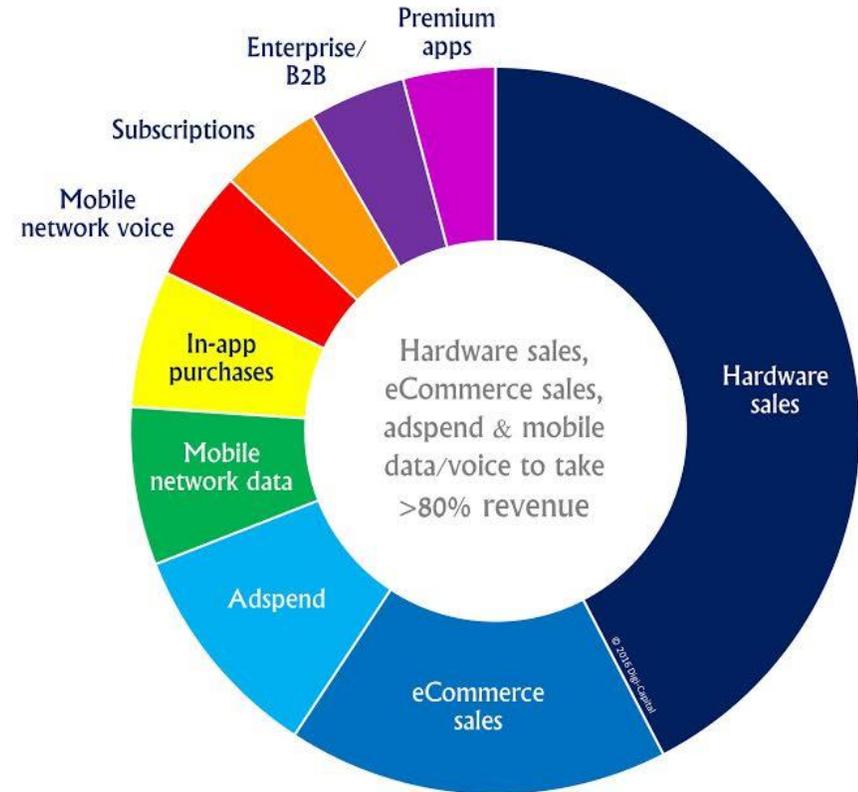
AR/VR Long-term Business Models

AR/VR Business Models by 2017



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AR/VR Business Models by 2020



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AR/VR Long-term Business Models

Hardware sales

Facebook paid \$2 billion for Oculus. Magic Leap took \$1.4 billion from Google (and others). Apple bought Metaio. Plus major commitments from Microsoft, HTC/Valve, Sony, Samsung and other heavyweights.

Apple owns global mobile hardware profits in the market it created, making it the most valuable company on the planet (mostly). Google has taken MVP as well, but increasingly relies on advertising sold using other people's mobile devices – even though it owns Android.

AR/VR could have an installed base in the low single-digit hundreds of millions by 2020, ranging from low-end VR Cardboard up to premium AR Magic Leap (and everything in between). With long-run unit prices from free up to something equal to top-end smartphone prices, hardware sales could drive more than \$4 of every \$10 spent on AR/VR by 2020.

E-commerce sales

Alibaba led Magic Leap's \$793.5 million round at a \$4.5 billion valuation, with vice chairman Joe Tsai joining the board. Alibaba and Tsai are amongst the best and brightest in China (and the world).

Why would a Chinese e-commerce company throw hundreds of millions of dollars at a Florida hardware startup with no sales?

E-commerce sales (goods and services, not in-app purchases) could take almost \$2 of every \$10 spent using AR/VR in five years' time.

Alibaba, Amazon, eBay and a range of new startups will be able to sell stuff to folks in totally new ways. Some of this might cannibalize existing e-commerce/m-commerce, but AR/VR could also grow e-commerce's share of all sales.

Advertising sales

For app and content developers (not selling hardware, goods or services), advertising sales could be the most valuable business model at around \$1 of every \$10 generated by AR/VR. The first AR advertising unicorn emerged this year with Blippar, and that's before the head-mounted display market hits its stride.

As advertising formats emerge, from virtual banner equivalents to full-blown, native AR/VR formats like The Martian VR Experience, AR/VR advertising could follow the path blazed by web and mobile. With one-third of global advertising and half of all Chinese advertising in web/mobile in 2016, platform change means serious business for advertisers. AR/VR advertising is more immersive than any rich media (when done right), and ad spend should follow the eyeballs.

AR/VR Long-term Business Models

Mobile network data/voice

Mobility will drive installed base for AR/VR.

For VR, installed base will be driven by price, with mobile VR solutions trending down from \$99 to free. Free is the most compelling price point, despite high-end VR giving a more complete experience (for now).

For AR, mobility is even more fundamental than for VR. AR devices that can't make phone calls or access cloud-based services all day out of Wi-Fi range won't be able to replace smartphones in the long run.

Mobile network data revenue from AR/VR could be golden for the telcos. YouTube estimates that each frame of 360 video requires 4-5 times the bandwidth of traditional video. AR/VR data could be the catalyst to break mobile networks out of their current annual revenue growth of less than 2 percent — so it's a big deal.

Mobile network voice revenue for AR/VR (voice with mobile Quality of Service, not VoIP) will largely cannibalize existing mobile voice revenues rather than add new revenues for the telcos. They'll be there, but this isn't new money.

In-app purchases

For mobile developers, in-app purchases are one of the core business models. Top-grossing mobile charts are dominated by free apps, and even premium console/PC games markets see downloadable content as a major business model. The AR/VR free versus paid app question is yet to be answered, but users have been trained that digital content is mostly free. Younger users, in particular, rarely pay for content, so there's no putting the free genie back in the bottle.

In-app purchases should be a major business model for AR/VR developers, whether through speed-ups/virtual items or additional services. There will be a premium apps market (see below), but in-app purchases could play as big a role in AR/VR as they already do in the mobile and web markets.

Subscriptions

Netflix, Amazon, Hulu, Spotify and others proved how effective subscription business models can be for web/mobile.

AR/VR content and SaaS players are set to offer services that folks will happily subscribe to every month (although these might come at the expense of other platforms).

Higher levels of service and ad-free services could drive AR/VR subscription revenues, although more innovative models may arise.

AR/VR Long-term Business Models

Enterprise/B2B

The enterprise market is well-served by AR players like Microsoft, Meta, ODG and DAQRI, as well as a range of VR service/solution providers. With use cases across military, medical, education, architecture, construction, maintenance and beyond, enterprise sales will be a driver for both AR and, to a lesser extent, VR.

Replacing traditional desktop/laptop machines might take some time, but business users will be able to improve productivity in specific areas. With HoloLens now on the International Space Station, AR/VR will reach new heights for enterprise users (pun intended).

B2B sales from AR/VR services/solutions providers will also be part of the mix. B2B revenues will come from areas like graphics engines, facial animation, gesture recognition, 3D model distribution and more.

Premium apps

Premium apps will have a role to play in AR/VR, despite the potential dominance of free apps. The higher-end the user experience, the greater the potential for paid business models.

High-end VR games could see the highest proportion of premium apps, leveraging an installed base of console/PC gamers accustomed to paying up to \$60 for their fun.

Non-games AR/VR consumer apps more broadly could see a lower proportion of premium apps, similar to the paid share of mobile apps today.

