

A Spatial Future Materializes

An ARtillery Intelligence Report



20
24
Edition

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Executive Summary

High-Water mark

Spatial computing – including AR, VR, and other immersive tech – continues to alter the ways that we work, play, and live. But there have been ups and downs, characteristic of hype cycles. The pendulum has swung toward over-investment, then toward market correction – leaving us now in a middle ground of reset expectations and moderate growth.

Meanwhile, recent history has brought a few notable milestones in XR subcategories ranging from mixed reality (MR) to low-immersion smart glasses, to the sector's new high-water mark: Apple Vision Pro.

Mixed Feelings

Taking those factors one at a time, MR has been elevated to a new market standard in VR, thanks to Meta Quest 3. HD color passthrough cameras not only broaden VR use cases and user friendliness but they advance AR. In other words, AR can live on, and be incubated within, the more mature and penetrated VR hardware market. This exposes AR by seeding its demand with a broader set of new users. And that's what Meta wants. Quest 3, among other things, is Meta's bridge to its longer-term AR ambitions.

The same can be said for Ray-Ban Meta Smart glasses (RBMS), which accommodate style and wearability while the visual UX is toned down. Meta will approach the holy grail of all-day AR glasses from both directions – smart glasses and mixed-reality headsets – which will someday meet in the middle.

Meanwhile, RBMS sets the bar for smart glasses with an AI-powered UX whose appeal lies not in graphical dimensionality but relevant information delivery. We're talking personal alerts, social signals, shopping & commerce, and AI-fueled object recognition.

Image Source: Meta



“With mixed reality, AR can live on, and be incubated within, the more mature and penetrated VR hardware market. This exposes AR by seeding its demand with a broader set of new users.”

Executive Summary

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That brings us to the big topic that's defined the tech sector over the past year: AI. The rise of generative and conversational AI from the likes of OpenAI has characterized the technological zeitgeist. But the big question is how it intersects with XR. In short, XR can be the face of AI, while AI is the brains of XR.

For example, as we explored in a recent report*, generative AI can aid in XR experience creation, thus automating and streamlining developer workflows. It can also transform user interfaces for XR devices ranging from smart glasses to mixed reality headsets. This is already seen in the AI object-recognition and personal-assistant functions of RBMS, as noted.

Experiential Spectrum

At the other end of the experiential spectrum, we have Apple Vision Pro. Shooting for the extent of what's possible in spatial computing today, it could seed demand for XR by making it sexy and coveted from a mainstream perspective. This is a status that's been elusive for AR and VR over the past decade.

*See ARtillery Intelligence Report: [Generative XR: AR & AI Converge](#).

This influence could take time, given Vision Pro's price tag and long evolutionary path. But in the meantime, Apple could lift all boats through its signature "halo effect." This unlocks opportunities for smaller players to meet XR's elevated demands at lower price points.

Beyond user-facing products, a spatial tech stack lies beneath. This involves a cast of supporting parts. We're talking processing muscle (Qualcomm), experience creation (Adobe), and developer platforms (Niantic). These are the engines of XR growth.

So how is all of this coming together? Where are we in spatial computing's lifecycle? And where are there gaps in the value chain that signal opportunity for AR and VR players? We'll tackle these questions and others in this report through numbers and narratives.

Image Source: Magic Leap



“AI can transform user interfaces for XR devices from smart glasses to mixed reality headsets – already seen in the AI object recognition of Ray-Ban Meta Smart Glasses.”

Introduction

The Pendulum

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The Pendulum

Big Swings

When looking at spatial computing, including AR, VR and everything in between, the term *hype cycle* is often invoked. Conceived by Gartner, it's a useful way to contextualize where these technologies sit in their lifecycles. Often, there's a period of over-investment, followed by market correction, then moderate growth.

Another analogy for these market developments is a pendulum. AR and VR swung toward over-investment and herd mentality that peaked around 2016. Then, technical and practical realities caught up with them... so they retracted. They swung toward market correction that peaked in 2020, after which a reborn industry grew at a more sober pace.

Pattern Recognition

We've seen such cycles before – most notably, the dot com boom/bust. “Irrational exuberance” was followed by retraction and scorched earth. Then, sprouting from those ashes were companies like Google, and revolutions like social media and the smartphone.

Early in that post-correction state is where we now stand in spatial computing's lifecycle. It's not the

revolutionary shift once touted, but it will create value in measured ways and in specific areas. XR may not revolutionize *everything*, but will elevate *many things*.

Beyond AR and VR, which sit at different lifecycle stages, all the above applies to the m-word... the metaverse. Though we won't talk about it much in this report as we've stayed away from the vapor and ambiguity that surrounds the term, it too has a lifecycle that will follow these patterns.

So where are we in that journey with AR and VR? Let's dive into the drivers and dynamics of each, starting with AR...

“Like a pendulum, these markets swung toward over-investment and herd mentality, then a correction, after which a reborn industry grows at a more sober pace.”



**Peak of
Shakeout
2020**

**Peak of
Exuberance
2016**

Today

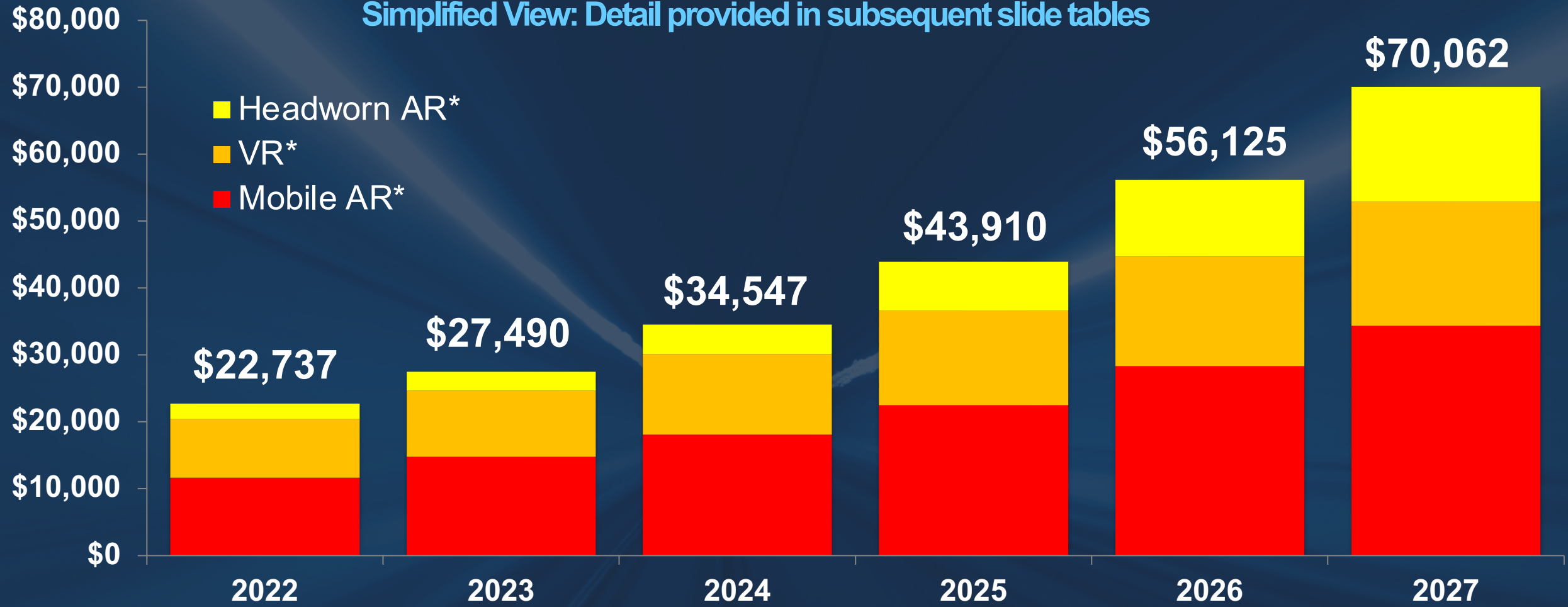
**Equilibrium
20??**

The Spatial Spectrum

U.S. \$Millions

What's the **Revenue Breakdown** Between **XR Sectors**?

Simplified View: Detail provided in subsequent slide tables



The Spatial Spectrum

What's the **Revenue Breakdown** Between **XR Sectors**?

U.S. \$Millions

	Mobile AR*	VR*	Headworn AR*	Total
2022	\$11,653	\$8,759	\$2,325	\$22,737
2023	\$14,765	\$9,912	\$2,813	\$27,490
2024	\$18,065	\$12,083	\$4,399	\$34,547
2025	\$22,456	\$14,183	\$7,270	\$43,910
2026	\$28,335	\$16,358	\$11,432	\$56,125
2027	\$34,348	\$18,551	\$17,163	\$70,062

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Part I Mobile AR

Mobile AR: Smartphone Scale

Here Today

To pick up where the previous section left off, AR is the modality in the spatial spectrum that holds the most promise due to its all-day utility. VR conversely is more isolating and therefore only viable within segments of a given user's day – like entertainment.

To pause for definitions, we consider AR to be any technology that digitally enhances a human experience. That includes immersive product try-ons, geo-located mobile gaming (e.g., Pokémon Go), and line-of-sight annotations that support industrial work. As we'll explore later, it also includes audio cues that empower users through situational intelligence. In all the above, the form factor can be headworn or mobile. The former is AR's fully-actualized modality, which we'll cover later. The latter conversely isn't as natural to real-world augmentation but it scales today.

Stepping Stone

To put some numbers behind that claim, of the **3.6 billion** global smartphones today, **3.18 billion** are compatible with at least one form of AR, including rudimentary web AR. This ubiquity is not only a path

to scale, but a stepping stone: mobile AR acclimates the world to immersive content so that AR glasses can have a softer landing. This goes for consumers as well as developers learning to *think spatially*.

Lastly, smartphones won't just be a means to an end, but a key piece of the AR glasses puzzle. By handling and hosting CPU, GPU, and wireless connectivity, smartphones will enable early-generation AR glasses to be lighter, cheaper, and more powerful. This will involve a progression of wired to wireless tethers, whereby your smartphone serves as the processing muscle and connectivity of your smart glasses.

Image Source: Apple

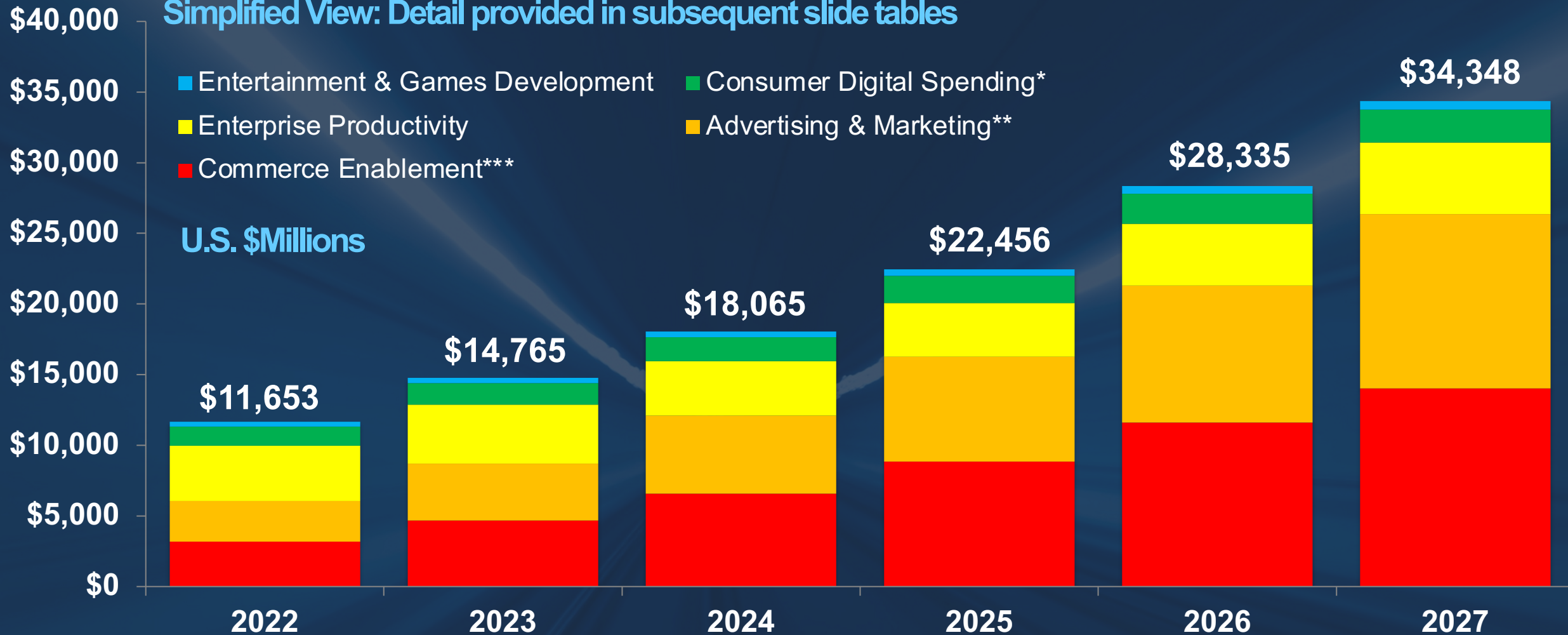


“This ubiquity is not only a path to scale, but a stepping stone: mobile AR acclimates the world so that AR glasses can have a softer landing.”

Mobile AR Revenue Overview

Consumer & Enterprise Mobile AR Revenue Estimates, by Source

Simplified View: Detail provided in subsequent slide tables



Mobile AR Revenue Overview

Consumer & Enterprise Mobile AR Revenue Estimates, by Source

U.S. \$Millions

	Commerce Enablement***	Advertising & Marketing**	Enterprise Productivity	Consumer Digital Spending*	Entertainment & Games Development	Total
2022	\$3,185	\$2,881	\$3,912	\$1,339	\$335	\$11,653
2023	\$4,664	\$4,028	\$4,181	\$1,514	\$378	\$14,765
2024	\$6,585	\$5,515	\$3,841	\$1,700	\$425	\$18,065
2025	\$8,836	\$7,435	\$3,806	\$1,903	\$476	\$22,456
2026	\$11,604	\$9,708	\$4,367	\$2,125	\$531	\$28,335
2027	\$14,017	\$12,354	\$5,061	\$2,334	\$583	\$34,348

Mobile AR: Players & Platforms

Naming Names

Mobile AR doesn't just tap into sheer scale but offers a wide variety of platforms. In other words, it's not just about the volume of AR-ready smartphones but the creation and delivery channels to reach all those devices. To name a few, there are native app development kits for iOS (ARKit) and Android (ARCore). These SDKs have democratized and scaled AR app creation to trusted and ubiquitous mobile operating systems.

Social apps like Instagram and Snapchat have meanwhile gained traction for AR lenses that enhance multimedia sharing. They've correspondingly built free developer platforms to boost lens creation and engagement. Then there's web AR*, including platforms like 8th Wall and Zappar, which bring AR to the mobile browser. Web AR advantages include less friction to launch AR, and amplified reach. Meanwhile, other influential AR platforms are developed by the likes of Niantic (consumer) and PTC (enterprise).

Full Stack

We also see innovators elsewhere in the tech stack launching AR developer platforms. For example,

Qualcomm's Spaces SDK lets developers build a range of AR experiences. By doing so, Qualcomm has doubled down on its position as the gold standard in chips that power XR devices. With a developer platform, it can now also realize the business and technological advantages of vertical integration. This enables it to develop tighter integration of software & silicon. And like many of the above platforms, it will be a worthwhile AR accelerant and enabler to watch.

Image Source: IKEA

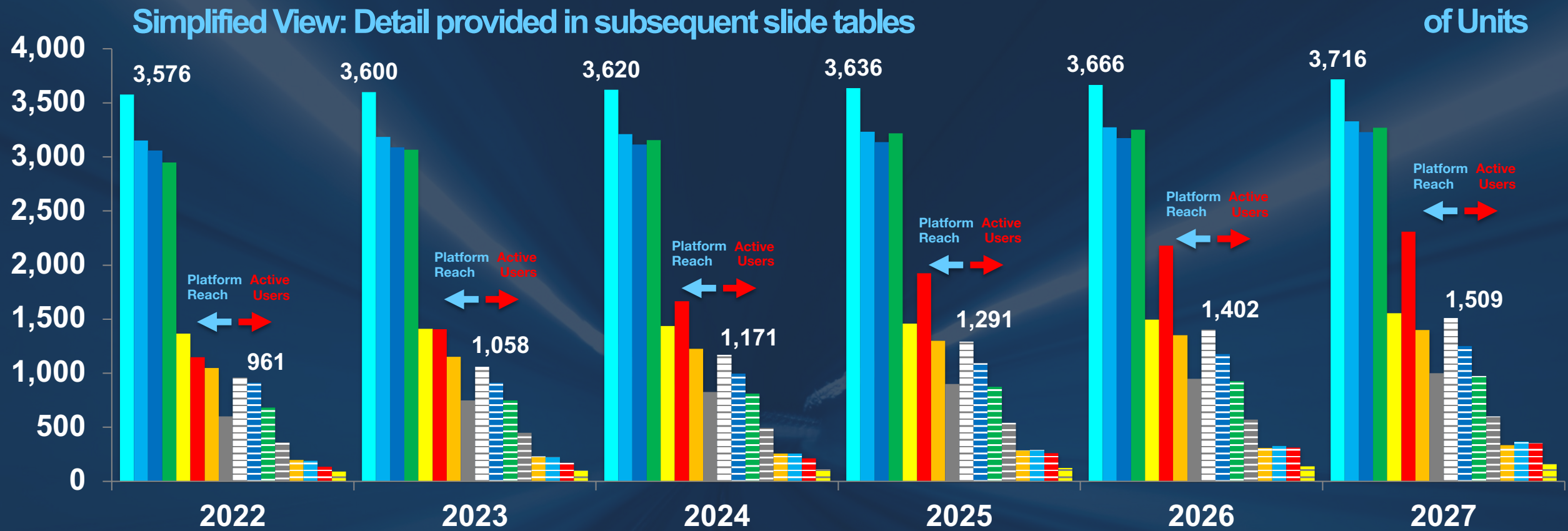


“Mobile AR doesn’t just tap into sheer scale, but variety. It’s not just about the volume of AR-ready smartphones but the delivery channels to reach all those devices.”

Mobile AR Global Penetration

AR-Compatible Devices & Active Users, Across Platforms*

Millions of Units



*Excludes platforms endemic to China.
**Includes iPad
***Google, Pinterest & Snap (de-duped)
**** Includes Facebook & Instagram

- Smartphones (of any type)
- Web AR (Devices)
- Visual Search (Devices)***
- Meta AR (Devices)****
- ARkit (Devices)**
- ARCore (Devices)
- TikTok (Devices)
- Snap Lenses (Devices)
- Total AR Active (de-duped)
- Visual Search (Active)***
- Meta AR (Active)****
- Snap Lenses (Active)
- TikTok AR (Active)
- Web AR (Active)
- ARCore (Active)*
- ARkit (Active)**



Mobile AR: Follow the Money

Immersive Marketing

In addition to enabling tech and creation tools, some of the players noted previously continue to establish and standardize AR revenue models. For example, one of the most popular forms of consumer AR so far has been interactive lenses that are distributed through social apps like Snapchat and Instagram.

These lenses lend themselves to brand sponsorship and paid distribution – a business model propelled by several factors. Not only is advertising the primary business model of the most popular social AR players, but AR lenses are naturally conducive to brand-sponsored experiences, and the results often show.*

Faces & Spaces

For example, branded AR lenses in channels like Instagram and Snapchat let consumers visualize products on “faces & spaces.” This involves paid distribution through these apps’ content discovery mechanisms and social graphs. Beyond paid amplification, brands can also self-distribute AR marketing experiences through their own apps.

In total, immersive marketing represents one of the leading AR revenue sub-sectors today, with spending estimated to reach **\$14.5 billion** by 2027 according to ARtillery Intelligence’s Global Mobile AR Forecast.**

Image Source: Amazon



*See ARtillery Intelligence Report: [AR Marketing Best Practices & Case Studies, Volume 3](#).

**See ARtillery Intelligence Report: [Mobile AR Global Revenue Forecast 2022-2027](#).

“Immersive marketing represents one of the leading AR revenue sub-sectors today, with spending estimated to reach \$14.5 billion by 2027.”

Mobile AR: Shoppable & Transactional



Follow the Eyeballs

So what's driving all that AR marketing revenue? First, users are demonstrating high engagement with AR lenses to enhance already-popular activities including media-sharing and enhanced selfies. Second, advertisers are attracted to those eyeballs. More specific to AR's advantages, advertisers are drawn to its ability to let them flex creative muscles and transcend 2D media where they've been confined for years. There's also a strong business case shown in ongoing campaign performance metrics,* as noted.

As for who's doing what to tap into that advertiser demand, Snap is a clear leader, due mostly to its dedicated focus on AR, and the technology's alignment with its "camera-company" mission. Meta also looms large with greater global scale through Facebook and Instagram.

Confident Consumers

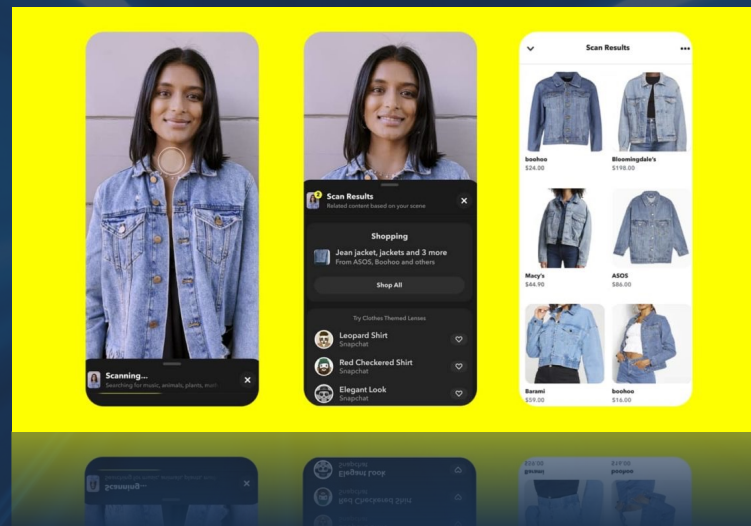
One reason that AR finds fertile ground with these apps is because they've cultivated shopping use cases. For example, Instagram has become a go-to

place for product discovery. As it increasingly becomes shoppable and transactional, AR adds to that shopping flow with product visualization and try-ons to engender more confident consumer purchases. Altogether, this shopping flow can be impactful.

Meanwhile, joining the mix is mobile AR's wild card: TikTok. Its global scale makes its AR efforts consequential, including its new developer platform, Effect House. Though early, it could be a powerful AR platform as it piggybacks on TikTok's reach and depth of engagement among **one billion+** global users.

“Joining the mix is mobile AR’s wild card: TikTok. Its global scale makes its AR efforts consequential, including its new developer platform, Effect House.”

Image Source: Snap



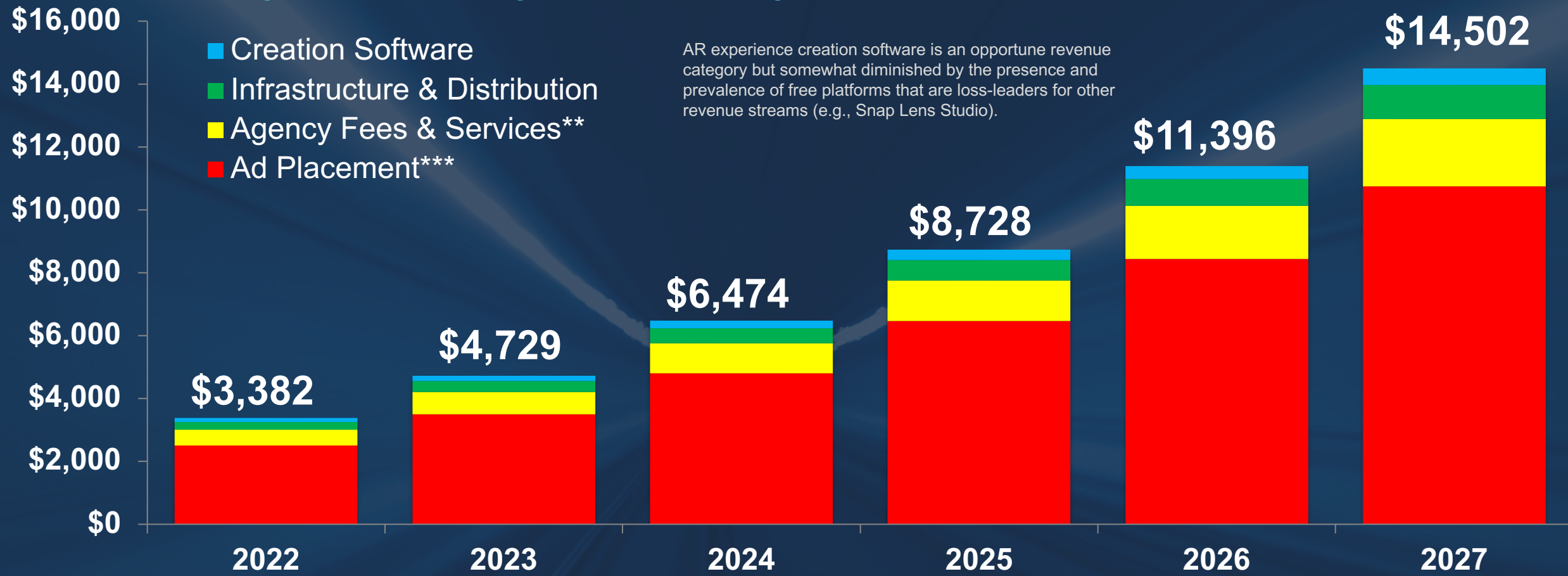
*See ARtillery Intelligence Report: [AR Marketing Best Practices & Case Studies, Volume 3](#).

Mobile AR Marketing Spend

Estimated spending on AR Brand Marketing*

U.S. \$Millions

Simplified View: Detail provided in subsequent slide tables



Mobile AR Marketing Spend

Estimated spending on AR Brand Marketing*

U.S. \$Millions

	Ad Placement	Agency Fees & Services	Infrastructure & Distribution	Creation Software	Total
2022	\$2,505	\$501	\$251	\$125	\$3,382
2023	\$3,503	\$701	\$350	\$175	\$4,729
2024	\$4,795	\$959	\$480	\$240	\$6,474
2025	\$6,465	\$1,293	\$647	\$323	\$8,728
2026	\$8,442	\$1,688	\$844	\$422	\$11,396
2027	\$10,742	\$2,148	\$1,074	\$537	\$14,502

Mobile AR: Visual Search

Search What You See

Beyond social lenses, a greater opportunity exists with visual search. It lets users point their phones at objects to identify them through informational overlays. This carries strong intent signaling – the same factor that makes web search so lucrative. Google calls it “search what you see.” It brings the on-demand utility of web search and puts a visual spin on it. In that way, visual search inherits the virtues of web search, while finding unique and native value that flows from its visual and proximity-based use.

Use cases showing early promise include shopping, education, and local discovery. For example, users can discover new restaurants through their phone’s camera, which can be more natural than typing or tapping text into Google Maps.

Killer App Ingredients

Across visual search’s potential use cases, common attributes include broad appeal and high frequency... again, just like web search. These factors give visual search a large addressable market in *quantity* of users and *volume* of usage. These are ingredients for killer apps. Meanwhile, these use cases have another

Common attribute: *shopping*. The endgame is monetizable visual searches for shoppable items. Actively holding up one’s phone to identify real-world items flows naturally into transactional outcomes... and Google knows it.

Amplifying these benefits is another factor: generation Z. It has a high affinity for the camera to interface with the world. And this will only grow as gen-Z collectively gains purchasing power and phases into the adult consumer population. This makes visual search a strong future-proofing move for Google and others.

Image Source: Google



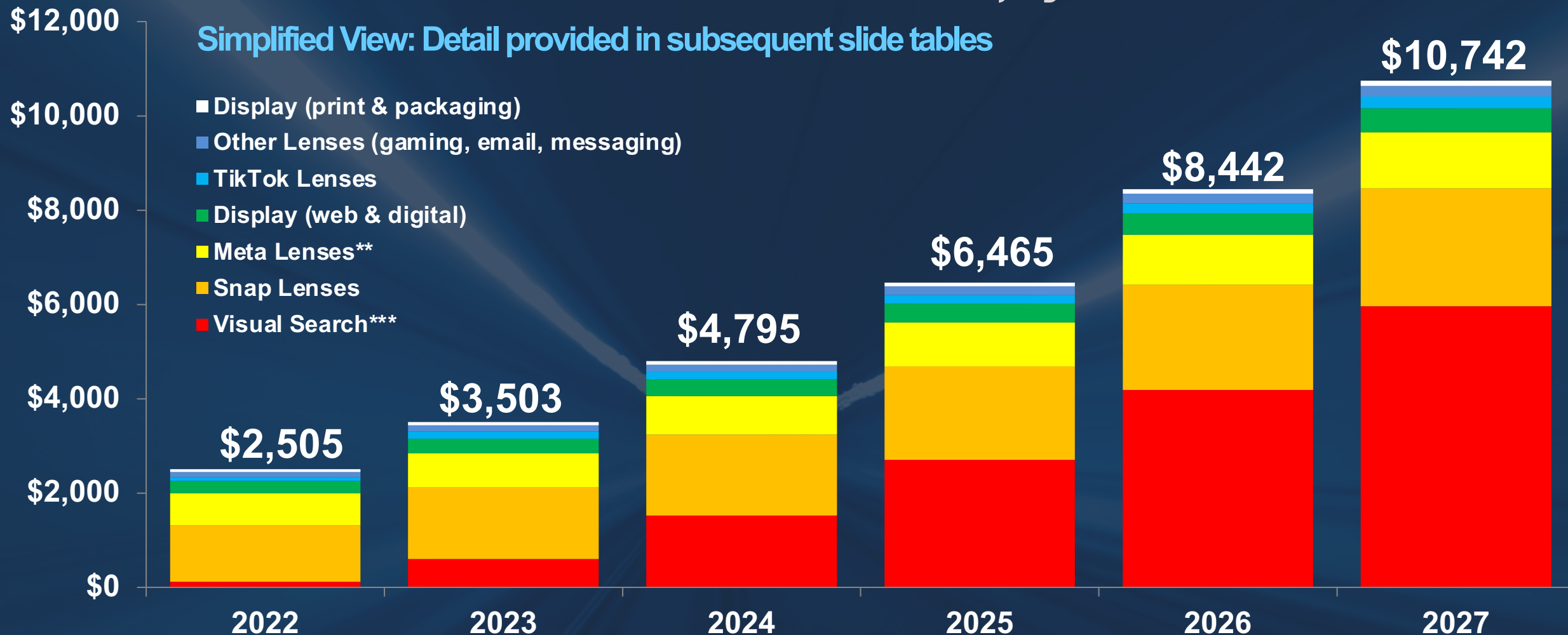
“Visual search lets users point their phones at objects to identify them. This carries strong intent signaling – the same factor that makes web search so lucrative.”

Mobile AR Ad Revenue

U.S. \$Millions

Mobile AR Estimated Paid Ad Placement, by Media Channel*

Simplified View: Detail provided in subsequent slide tables



*Includes estimated paid media placement only. Does not include self-distributed marketing, agency fees or creation software.

*Doesn't include platforms endemic to China.

**Includes Facebook, Instagram, and all Meta properties that distribute AR lenses.

***Includes Google Lens, Pinterest Lens and Snap Scan.

Mobile AR Ad Revenue

Mobile AR Estimated **Paid Ad Placement**, by Media Channel*

U.S. \$Millions

	Visual Search***	Snap Lenses	Meta Lenses**	Display (web & digital)	TikTok Lenses	Other Lenses (gaming, email, messaging)	Display (print & packaging)	Total
2022	\$119	\$1,201	\$679	\$260	\$75	\$112	\$59	\$2,505
2023	\$603	\$1,511	\$730	\$306	\$153	\$137	\$62	\$3,503
2024	\$1,525	\$1,713	\$818	\$353	\$159	\$155	\$71	\$4,795
2025	\$2,708	\$1,979	\$931	\$400	\$187	\$179	\$81	\$6,465
2026	\$4,184	\$2,231	\$1,062	\$450	\$218	\$203	\$93	\$8,442
2027	\$5,960	\$2,499	\$1,194	\$504	\$253	\$226	\$107	\$10,742

*Includes estimated paid media placement only. Does not include self-distributed marketing, agency fees or creation software.

*Doesn't include platforms endemic to China.

**Includes Facebook, Instagram, and all Meta properties that distribute AR lenses.

***Includes Google Lens, Pinterest Lens and Snap Scan.

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Mobile AR: The Knowledge Graph



Highly Motivated

Speaking of future proofing, Google is primed for visual search. Its knowledge graph – built from 20+ years as the world’s search engine – engenders a training set for AI image recognition, including products (Google Shopping) general interest (Google Images), and storefronts (Street View). Google is also highly motivated to lead the way in visual search. Along with voice search, it helps the company boost query volume, which correlates to revenue.

As Google drives things forward, ARtillery Intelligence projects that visual search will grow from **\$119 million** in 2022 to **\$5.96 billion** in 2027. Though it’s under-monetized today – a model that will eventually evolve to mirror sponsored results in web search – it will grow to a leading share of mobile AR ad revenue by 2027.

Not Alone

Though Google leads the way in visual search, it’s not alone. Pinterest Lens and Snap Scan are keen on visual search. And each player’s approach traces back to its core products and company ethos. To that end, Google Lens will work toward “all the world’s information,” while Pinterest Lens works with food & style, and Snap Scan prioritizes fun & fashion.

Beyond these companies, a few unlikely players are starting to emerge. For example, Meta surprised the world with the quality of its second-generation Ray-Ban Meta Smartglasses. One central feature is AI-fueled object recognition and language translation. Using the power of AI, it can identify what the user is looking at (visual input), and then whisper answers (audible output). This could represent the new face of visual search, not to mention the next era of AR, as we’ll explore in the next section...

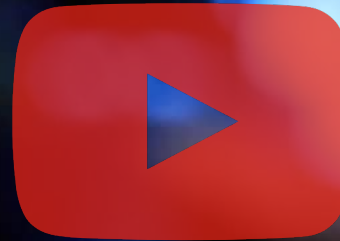
Image Source: Google



“Google’s knowledge graph engenders a training set for AI image recognition, including products, general interest, and local storefronts.”

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Mobile AR Revenue Outlook

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Headworn AR: The Endgame

Fully-Actualized AR

Moving from handheld to headworn, though AR glasses haven't arrived en masse, they represent a fully-actualized AR modality that will unlock the technology's true potential. In fairness, AR glasses have already arrived in the enterprise. There, AR glasses' style crimes, including bulky hardware, aren't the deal breaker that they are in consumer markets.

To that end, consumer/enterprise spending shares could flip as AR glasses gradually gain style and "wearability." Consumer markets are generally larger than enterprise markets due to population sizes... but enterprise spending often leads in early days of emerging tech. And that's what we're seeing in AR.

By the Numbers

To quantify the above, ARtillery Intelligence projects AR glasses spending to grow from **\$2.33 billion** in 2022 to **\$17.2 billion** in 2027. Enterprise spending is **93 percent** of that total today but will retract to **82 percent** by 2027 and continue to decline from there until consumer/enterprise trendlines intersect.

But that could take several years, not just due to requisite technical advancements, but also cultural acceptance. As seen in the Google Glass era, consumer acceptance and comfort for face-worn hardware (with a camera, no less) is a critical gating factor. But those barriers could be gradually eroding due to several macro factors and recent market developments we'll explore later in this section.

Image Source: Microsoft



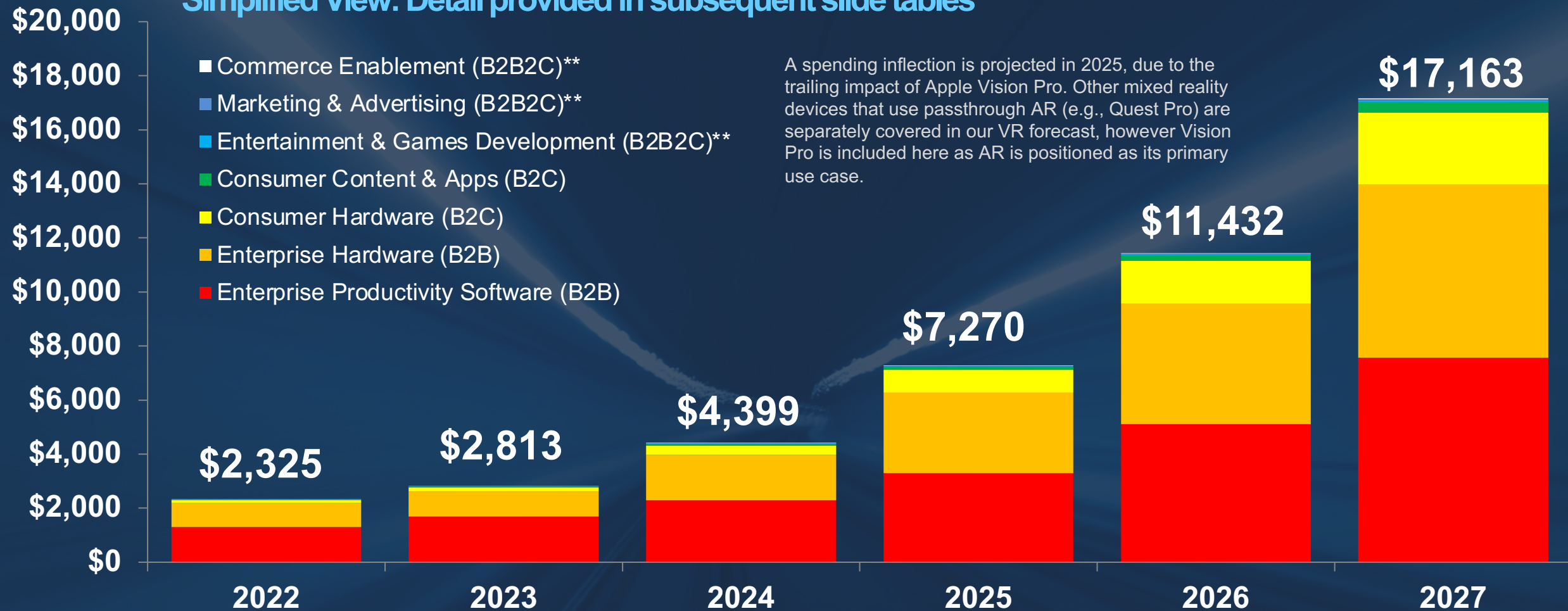
“As seen in the Google Glass era, consumer acceptance and comfort with face worn hardware – with a camera, no less – is a critical gating factor.”

Headworn AR Revenue Estimates

Consumer & Enterprise AR Glasses Revenues, by Source*

U.S. \$Millions

Simplified View: Detail provided in subsequent slide tables



Headworn AR Revenue Estimates

Consumer & Enterprise AR Glasses Revenues, by Source*

U.S. \$Millions

	Enterprise Productivity Software (B2B)	Enterprise Hardware (B2B)	Consumer Hardware (B2C)	Consumer Content & Apps (B2C)	Entertainment & Games Development (B2B2C)**	Marketing & Advertising (B2B2C)**	Commerce Enablement (B2B2C)**	Total
2022	\$1,298.20	\$883	\$120	\$20	\$3	\$0	\$0	\$2,325
2023	\$1,696	\$924	\$148	\$38	\$6	\$1	\$0	\$2,813
2024	\$2,285	\$1,685	\$346	\$66	\$11	\$3	\$1	\$4,399
2025	\$3,293	\$2,981	\$850	\$114	\$19	\$9	\$5	\$7,270
2026	\$5,112	\$4,454	\$1,586	\$210	\$36	\$20	\$14	\$11,432
2027	\$7,572	\$6,409	\$2,653	\$383	\$66	\$44	\$36	\$17,163

Headworn AR: Hard at Work



Style Crimes

While consumer AR challenges are being worked out, smart glasses have found less resistance in the enterprise. As noted, the technology's style crimes are less of an issue in the enterprise, and it has a clearer business case. That includes operational efficiencies that are brought by line-of-sight visualization.

Led by tools such as PTC Vuforia, Scope AR, and Microsoft Mesh, remote collaboration, industrial support and other valuable functions can be enabled. The scale and impact of such deployments will also be meaningful as AR will continue to span enterprise verticals and environments – everything from corporate settings to industrial factory floors.

Institutional Knowledge

To illustrate these scenarios further, in key functions like industrial assembly and maintenance, AR can expedite task completion and reduce errors. It accomplishes these ends by lessening cognitive load from “mentally mapping” 2D instructions to 3D space. There are several macro benefits too, such as retaining and disseminating institutional knowledge.

Drilling down on the latter, it's all about mitigating knowledge loss from seasoned personnel retiring. Because baby boomers are retiring at a greater pace, not to mention the Covid-era “great resignation,” it's getting harder to retain institutional knowledge – an expensive problem for industrial enterprises.

Image Source: Microsoft



“In key functions like industrial assembly and maintenance, AR can expedite task completion and lessen cognitive load from ‘mentally mapping’ 2D instructions to 3D space.”

Headworn AR: Hard at Work



...Cont'd from previous page

For all the reasons on the previous page, ARtillery Intelligence has estimated that AR spending on enterprise productivity will grow from **\$1.3 billion** in 2022 to **\$7.8 billion** in 2027, a **42.3 percent** compound annual growth rate. This includes head-worn AR (hardware and software spending) and mobile & tablet-based AR (software spending only).

Pilot Purgatory

But even though AR boasts these advantages, it's easier said than done to execute. Practical and logistical barriers stand in the way – such as organizational inertia, politics, change management, and fear of new technology among key stakeholders.

For example, the biggest stumbling block for enterprise AR is the dreaded “pilot purgatory.” This is when AR is adopted at the pilot stage but never progresses to full deployment. It's the biggest pain point in industrial AR, and there are many reasons for it...most of them cultural.

*See ARtillery Intelligence Report: [Enterprise AR Best Practices & Case Studies, Volume 3](#).

An ARtillery Intelligence report in 2023 featured several case studies,* including tactics for avoiding pilot purgatory. An upcoming report will advance the narrative with a fresh batch of case studies that represent the latest challenges and strategies in enterprise AR. These case-study-driven reports will be an annual exercise, currently in Volume 4.

Image Source: Microsoft



“Practical and logistical barriers stand in AR’s way – such as organizational inertia, politics, change management, and fear of new technology.”

Headworn AR: Apple of My Eye

Halo Effect

Moving on to consumer AR glasses, there's one company that has the potential to jumpstart the market: Apple. Indeed, many AR proponents are hoping it can accelerate the AR market through its signature "halo effect." This manifests in Apple Vision Pro (AVP), but the device should be seen as a first step towards Apple's spatial computing long game.

Stepping back, Apple's motivation with AVP is to vault its core hardware business in the face of a maturing smartphone market. To that end, its game plan these days is all about revenue diversification. As smartphones reach maturity and revenue deceleration, the company must find other ways to maintain revenue growth, and do so at massive scale.

Raison D'être

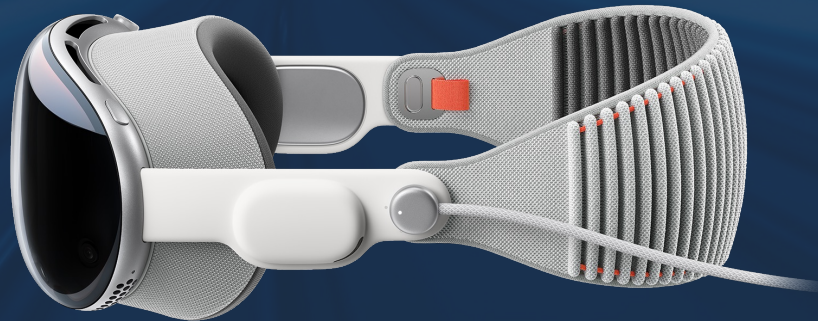
This is the raison d'être for Apple's wearables and services divisions. And AVP feeds into both. For wearables, revenue each quarter mostly offsets year-over-year iPhone revenue declines. Services (e.g., Apple TV+) meanwhile reached **1-billion** users in Q3 2023, with revenues that likewise offset and exceeded iPhone revenue declines. Consequently, wearables

and services hold a great deal of importance, investment, and political capital in Cupertino.

So how does AVP align with that wearables play? The device will sync with sensory experiences in Watch and AirPods. Visuals will join spatial audio and biometrics (think: immersive fitness). And Apple's signature ARPU-boosting ecosystem approach incentivizes you to buy several devices for continuity.

For example, Apple has developed a finger pinch to control Apple Watch. This is suspiciously similar to the primary gestural input for AVP, suggesting that Watch will be an additive companion device. Similarly, AirPods spatial audio was recently upgraded for low-latency use cases. And the iPhone 15 records spatial video for stereoscopic playback on AVP.

Image Source: Apple



“As smartphones reach maturity and revenue decelerates Apple finds other ways to maintain revenue growth. This is the raison d'être for Apple's wearables and services divisions.”

Headworn AR: Apple of My Eye

...Cont'd from previous page

But one question that continues to loom over AVP – as with any early tech product – is what's its main draw and primary function? This is otherwise known as a killer app, and they often take years to develop as we witnessed with the iPhone and other tech cycles.

Meanwhile, some clues can already be seen in the use cases that Apple has put forward in its AVP unveiling. For example, entertainment will be a central use case, given the device's immersive capacity. This includes private immersive viewing environments, such as at home and in-flight entertainment.

Waiting & Watching

Returning to our ongoing “follow the money” framework for examining big-tech motivations, the field of entertainment is an AVP use case that aligns with Apple's expanding content and subscription businesses. And that goal aligns with Apple's revenue-diversification imperative introduced on the previous page. It's also a use case that everyone can understand. That “approachability” and scalability concept underpins almost everything Apple releases.

Sticking with that last point, Apple – as it often does – has been waiting and watching the AR sector for the past several years and observing its mistakes. And one of the biggest mistakes has been AR's tendency to get stuck in techy territory, including esoteric messaging and acronyms. So when looking for killer apps to drive Vision Pro's demand – besides sex appeal around its sheer gadgetry – an elite entertainment experience was a natural choice.

Image Source: Apple



“Entertainment is an AVP use case that aligns with Apple's content subscription businesses, pursuant to its revenue-diversification goals.”

Headworn AR: Apple of My Eye

...Cont'd from previous page

Going one level deeper into entertainment use cases, one subset could be especially opportune: *spectator sports*. Like entertainment broadly, this has mass appeal and natural monetization which, again, aligns with Apple's central revenue diversification goals.

Sports also represent a potentially-meaningful product/market fit. In other words, immersive tech taps into the visceral and participatory nature of spectator sports. That value is amplified wherever front-row seats carry a premium. It's all about the squeaking hardwood in basketball or the sound of slapshots and bodies smashing into boards in hockey.

Sporting Chance

These fan experiences were the promise of NextVR and its early work with teams like the Golden State Warriors.* And guess what... Apple acquired NextVR in 2020 to seed this evolutionary path. Other moves in that master plan include securing broadcast rights such as MLS and MLB, with NBA rumored to be next.

*See the author's [on-stage interview](#) with the G.S. Warriors.

The unit economics also work. If Apple can sell live virtual front-row seats for \$9 – or bundled season passes for superfans – it could reach a sizable market. That market also scales beyond the geographic constraints of a given team. There's a massive NBA following in China for example.

For fans, this doesn't beat attending live sporting events but it immerses them in the action for a fraction of the price, time, and effort. Both modalities will coexist as Vision Pro augments the fan experience. It will take a while for Apple to get there – and require lowering AVP's price – so consider it early innings.



“Immersive tech taps into the visceral and participatory nature of sports. It’s all about the squeaking hardwood in basketball or bodies smashing into boards in hockey.”

Headworn AR: Apple of My Eye

...Cont'd from previous page

Sticking with use-case possibilities, there are several other directions revealed or teased during AVP's unveiling. For example, Apple has leaned into the concept of virtual screens in enterprise contexts. This involves personalized high-end virtual workspaces (remote-work-friendly) with several monitors that can be moved around with intuitive gestural inputs.

This screen replacement concept is compelling but should be balanced with a technical reality check, such as detailed engineering and optics breakdowns provided by the venerable Karl Guttag.*

Immersive & Lifelike

In addition to screen replacement, a productivity use case is furthered through the ability to conduct collaborative Facetime calls with colleagues (or in social contexts). AVP can array callers' faces all around the room in an immersive way, while reciprocating the user's presence as a photorealistic avatar with A/V syncing for spoken communication.

*See Guttag's full analysis [here](#).

Meanwhile, other use cases will flow from the multi-device wearables integrations explored earlier, such as health and fitness apps that sync with the biometrics tracked by one's Apple Watch.

Capturing memories that feel immersive and lifelike will be another use case that could resonate in a mass-market sense (again, Apple's top goal). This involves capturing spatial video directly on one's AVP. A more realistic behavior will be to use the iPhone 15 Pro Max's advanced camera array – which will trickle down to a ubiquitous state over the next few iPhone generations – to capture spatial video for AVP playback.

Image Source: Apple



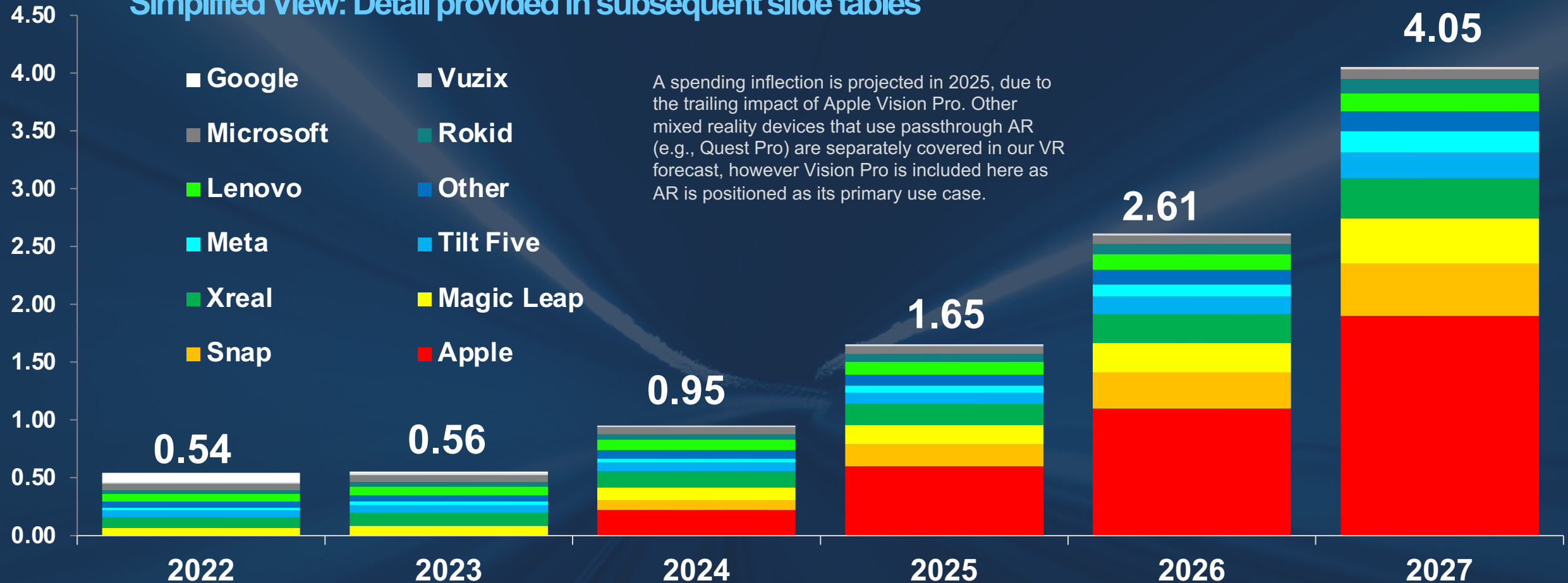
“In addition to screen replacement, a productivity use case is furthered through the ability to conduct collaborative Facetime calls.”

AR Glasses Unit Estimates

Millions of Units

AR Glasses Annual Unit Sales* by Brand

Simplified View: Detail provided in subsequent slide tables



AR Glasses Unit Estimates

AR Glasses **Annual Unit Sales*** by Brand

Millions of Units

	Apple	Snap	Magic Leap	Xreal	Tilt Five	Meta	Other	Lenovo	Rokid	Microsoft	Vuzix	Google	Total
2022	0.00	0.00	0.07	0.09	0.06	0.03	0.05	0.07	0.03	0.06	0.01	0.09	0.54
2023	0.00	0.00	0.09	0.11	0.07	0.03	0.06	0.08	0.04	0.06	0.01	0.02	0.56
2024	0.22	0.09	0.11	0.14	0.08	0.04	0.07	0.09	0.05	0.06	0.01	0.00	0.95
2025	0.60	0.19	0.17	0.18	0.10	0.06	0.10	0.11	0.06	0.07	0.02	0.00	1.65
2026	1.10	0.31	0.25	0.25	0.15	0.11	0.13	0.14	0.09	0.07	0.02	0.00	2.61
2027	1.90	0.46	0.39	0.35	0.23	0.18	0.17	0.16	0.12	0.09	0.02	0.00	4.05

Headworn AR: Smart Play



The Landscape

To further define the AR glasses landscape, there are various hardware classes. At one end of the spectrum is "heavy AR" represented by Apple Vision Pro. This is AR's most immersive modality, but it involves higher cost and hardware bulk. We're also seeing more mixed reality devices like Quest 3 (examined in the next section), where AR is given the chance to shine through its incubation in VR hardware.

Elsewhere in the AR hardware spectrum are mid-range devices that dial down the optical complexity to gain *wearability*. Devices like Xreal Air 2 offer private immersive viewing for "flat" content such as movies and 2D games. Though less immersive, private big-screen viewing with familiar formats resonates with consumers,* especially if it comes in a cheaper, lighter, and more stylistically-viable package.

Shedding Pounds

Lastly, there's an emerging form of AR that we simply call "lite AR." This involves basic information delivery, such as text or even audio. Here, the value of the content delivered lies not with its graphical complexity nor dimensionality but rather its personal relevance.

That last part is critical and leans on an increasingly influential factor in AR: artificial intelligence. In order to truly deliver relevant information – thus making up for the lack of graphical richness – AI-driven personalization is required. We're talking social signals (are my friends nearby?), interest-graph signals (where is the closest coffee shop?) and commerce signals (where do I buy that jacket?).

Or, as Mark Zuckerberg put it from the stage at the recent Meta Connect conference when launching Ray-Ban Meta Smart Glasses.

"Before the last year's AI breakthroughs, I kind of thought that smart glasses were only really going to become ubiquitous once we really dialed in the holograms and the displays, which we are making progress on but is somewhat longer. But now I think that the AI part of this is going to be just as important in smart glasses being widely adopted as any of the augmented reality features."

*See ARtillery Intelligence Report: [VR Usage & Consumer Attitudes, Wave VII](#).

"In order to truly deliver relevant information – thus making up for the lack of graphical richness in near-term smart glasses – AI-driven personalization is required."

Headworn AR: Smart Play

...Cont'd from previous page

Sticking with that last AR modality – lite AR – it has the most near-term potential, or what's often called “the art of the possible.” If relevant and personally-useful data can indeed be delivered in a glasses-based format, it could sidestep one of AR's longstanding and vexing design challenges: hardware bulk. In other words, lite AR's graphical and audible functions can be accomplished in glasses people will actually wear.

All the above was advanced recently with the launch of Ray-Ban Meta Smart Glasses, as hinted on the previous page. A big leap from the device's first generation, they carry impressive specs and a focused use case with a large addressable market: live streaming. This combination of factors could spark the adoption inflection that AR needs. But to be clear, Meta's latest glasses only deliver information via audio, though future generations are projected to have display and optical systems for simple visual data.

Timing is Everything

One question that remains is cultural acceptance for lite AR, given that it relies on outward-facing cameras

for media capture and livestreaming functions. But signs point to a potential cultural readiness for this previously shunned behavior.

For example, Google Glass' famous fails were due mostly to cultural sensibilities at the time. There was widespread privacy-related discomfort with smart glasses that can record video. But we now live in the age of livestreaming, where recording video and audio is commonplace. The question is if it will be accepted in glasses form. If so, the combination of this cultural readiness and a new batch of more capable smart glasses could signal a turning point for headworn AR.

Image Source: Meta



“Google Glass’ famous fails were due mostly to cultural sensibilities at the time. But we now live in the age of livestreaming, where recording video and audio is commonplace.”

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ARtillery Briefs, Episode 74

Headworn AR Revenue Outlook

Part III

VR

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VR: Industry Snapshot

Spatial Cousin

Moving on from AR, what about its spatial cousin, VR? It's a promising technology in entertainment, gaming, and some enterprise functions. But it's not the revolution in computing that was touted a few years ago. Traction continues to be challenged.

That said, VR has some bright spots. Revenue is projected to grow from **\$8.8 billion** in 2022 to **\$18.5 billion** in 2027, a **16.2 percent** compound annual growth rate. Much of this is driven by Meta's investments, including billions in quarterly R&D spend. This buys the company a technological edge. Its investments also involve subsidizing hardware through a loss-leader approach that stimulates a larger installed base. That in turn works toward a network effect and attracts reach-driven content creators.

Exit Potential

To that last point, one factor that makes or breaks a given VR platform is content availability. Meta continues to invest in content by attracting developers to a larger hardware base as noted, as well as acquiring VR publishers and game studios. The latter injects cash into content creation and incentivizes

content creators to enter the market (and venture funding to fuel them) through exit potential.

But it's not all good news, as Meta has seen unit sales declines in 2023, mostly due to the waning lifecycle of Quest 2. Meta is hoping that Quest 3 will invigorate demand by stimulating or accelerating a hardware replacement cycle. Meanwhile, Quest 2 has arguably reached market saturation relative to VR's current demand levels. We'll go deeper into the dynamics of Quest 3 and mixed reality later in this section.

Image Source: Meta



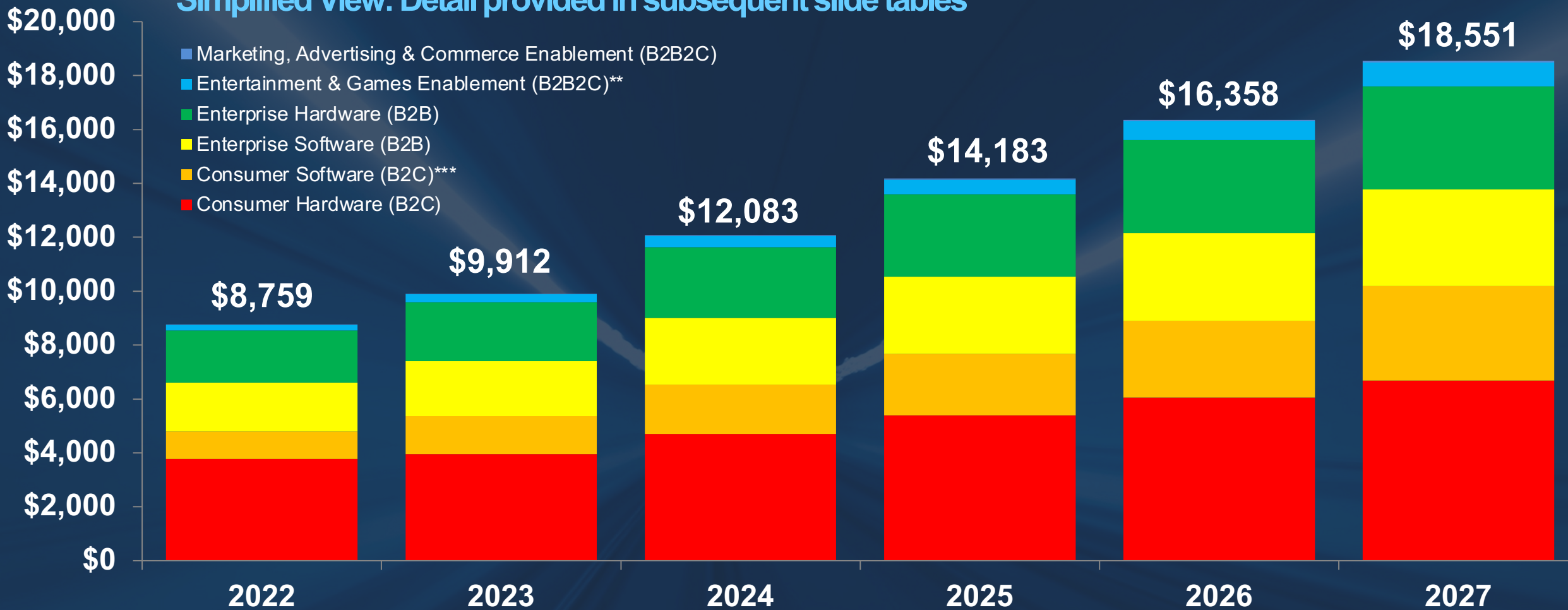
“VR’s biggest accelerant is Meta’s investments, including billions in quarterly R&D spend. This buys the company a technological edge, among other things.”

Global VR Revenue Overview

U.S. \$Millions

Consumer & Enterprise VR Revenue Estimates, by Category*

Simplified View: Detail provided in subsequent slide tables



*Includes tier-1 console and PC VR (e.g., PSVR), tier-2 standalone VR (e.g., Quest 2) and tier-3 personal entertainment devices (e.g., VIVE Flow).
**Enterprise spending on consumer VR development & distribution (includes LBVR hardware and software licensing).
***Consumerrr spending on VR content, apps and experiences (including LBVR admissions).

Global VR Revenue Overview

Consumer & Enterprise VR Revenue Estimates, by Category*

U.S. \$Millions

	Consumer Hardware (B2C)	Consumer Software (B2C)***	Enterprise Software (B2B)	Enterprise Hardware (B2B)	Entertainment & Games Enablement (B2B2C)**	Marketing, Advertising & Commerce Enablement (B2B2C)	Total
2022	\$3,779	\$1,011	\$1,816	\$1,942	\$203	\$8	\$8,759
2023	\$3,956	\$1,409	\$2,044	\$2,180	\$305	\$18	\$9,912
2024	\$4,697	\$1,840	\$2,466	\$2,623	\$427	\$29	\$12,083
2025	\$5,399	\$2,268	\$2,873	\$3,052	\$546	\$44	\$14,183
2026	\$6,052	\$2,853	\$3,251	\$3,447	\$700	\$55	\$16,358
2027	\$6,679	\$3,514	\$3,583	\$3,828	\$878	\$68	\$18,551

*Includes tier-1 console and PC VR (e.g., PSVR), tier-2 standalone VR (e.g., Quest 2) and tier-3 personal entertainment devices (e.g., VIVE Flow).

**Enterprise spending on consumer VR development & distribution (includes LBVR hardware and software licensing).

***Consumerrr spending on VR content, apps and experiences (including LBVR admissions).

VR Hardware Penetration

Millions of Units

Unit Sales & Installed Base Estimates



VR: Present & Future

Not Alone

Though this section so far has focused on Meta, as its investments accelerate and define the VR landscape, there are other notable players. They include Valve Index in PC VR and PSVR 2 in console VR. And in the standalone category, competing with Quest 3 and Quest Pro, is the venerable Vive XR Elite. With high-definition cameras for color passthrough AR, it's a formidable contender in the increasingly-accessible and prevalent mixed-reality segment.

Mixed Signals

Speaking of mixed reality, among all the events in 2023's VR scene, the standout product launch was likely Meta Quest 3. It uplevels Quest 2's specs across the board and is more importantly a bridge toward Meta's AR ambitions. It accomplishes this through color passthrough cameras that display the outside world, much like Vive XR Elite.

This approach embodies Meta's spatial computing evolution, which spans VR and AR. Most of its focus has been on the former but it's increasingly tackling the latter. This involves a two-track approach. The first

track occurs through evolving lite-AR capabilities in Ray-Ban Meta Smartglasses, as examined in the previous section. And the second track involves passthrough AR in its VR flagships. In that sense, Quest 3 represents an emerging class of mixed reality devices that accelerated in 2023, and will evolve and gain market share in 2024.

Image Source: HTC



“Quest 3 not only uplevels Quest 2’s specs across the board but is more importantly a bridge toward Meta’s AR ambitions – accomplished with color passthrough cameras.”

cameras,”
color passthrough
accomplished with
ambitions –

VR: Now with More MR

Tables & Floors

Picking up where the previous page left off, 2023 was defined by a new class of VR devices that feature full-color HD passthrough cameras. Characterized by Quest 3 and Vive XR Elite among others, mixed reality is becoming a primary feature in VR. To define mixed reality in this context, it utilizes passthrough cameras to bring the outside world into VR.

One advantage of this modality is that this broadens VR's appeal and use cases, including experiences that interact with the physical world as opposed to being occluded and insular. These expanded use cases include everything from workplace productivity (think: floating virtual monitors), to gaming that interacts with one's space (think: tables and floors).

Populated & Penetrated

Beyond offering a more comprehensive set of VR use cases, mixed reality's list of advantages includes elevating AR, as noted. In other words, the byproduct of mixed reality's rise will be an acceleration in headworn AR exposure. This will happen as AR piggybacks on – and is incubated within – the more

popular and penetrated VR format. As a result, more consumers will get a taste for headworn AR, and many will like what they see.

Backing up, AR can be bisected into two formats: passthrough and see-through. Passthrough AR is offered in Quest 3 and other VR devices. And though it's not AR's endgame and ideal self – due to bulkier hardware that precludes all-day wearability – it offers advantages over see-through AR.

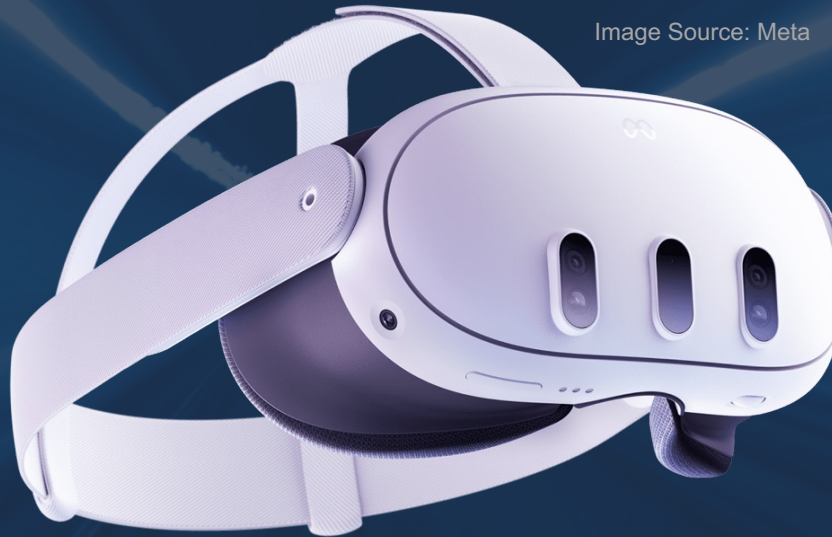


Image Source: Meta

“Beyond offering a comprehensive set of VR use cases, mixed reality’s list of advantages includes elevating AR. This will happen as AR piggybacks on the more popular and penetrated VR.”

VR: Now with More MR

...Cont'd from previous page

Among passthrough AR's advantages, it offers full control of every pixel of a VR display. This means greater definition, contrast, and field of view. See-through AR is conversely bound by physics such as manipulating (and often losing) light through waveguides, lenses, and optical combiners.

And because the background in see-through AR is the physical world, it's difficult to recreate the color black as you can with pixels on a display, leading to sub-optimal contrast levels and washed-out images. Features like local dimming help when competing with natural light, but several physical challenges persist.

Practical Outcome

As noted, the mixed-reality torch is being carried by Meta, given the positioning and priorities seen in Quest 3. But to be fair, Meta isn't the first to market with passthrough AR. Hardware from Varjo for example (see XR-3) has been available for a few years with high-quality color passthrough AR.

But Meta's entrance, including its signature loss-leader pricing, has introduced the element of

affordability, thus bringing mixed reality to a wider addressable market. This is where AR's accelerated exposure noted on the previous page will factor in, given Meta's greater mainstream reach.

The practical outcome of all the above is that Meta has established a new VR standard with Quest 3, which we're predicting will become table stakes in 2024. As this plays out, and consumers get a taste for mixed reality, it will be difficult for VR players to compete without it.

Image Source: Varjo



“Passthrough AR offers full control of every pixel of a VR display. This means greater definition, contrast, and field of view. See-through AR is bound by physics, such as manipulating light.”

VR: Now with More MR

...Cont'd from previous page

Beyond consumer demand, developer dynamics and feature parity among platforms will factor in. In other words, VR developers who want to offer mixed reality features or “MR modes” in their games will be attracted to platforms that offer that capability, putting others at a disadvantage. This will further drive mixed reality’s table stakes position as a competitive imperative, as examined on the previous page.

Meanwhile, beyond Meta, HTC and others, one can’t invoke mixed reality without acknowledging Apple Vision Pro (AVP). Much of the above analysis applies to AVP, however it will stand on its own at the high end (like Varjo hardware but potentially more penetrated). Regardless, its classic halo effect will lift all boats in the MR sea, as we examined earlier in this report.

Bridge to AR

Finally, stepping back, mixed reality is a bridge to AR glasses, in addition to a feature unto itself. The other “bridge” is AI-powered smart glasses as noted earlier in this report. Meanwhile, the co-existence of these two tracks is important. The first track – AR via VR –

will endeavor to slim down over time, while the second track – low-immersion smart glasses – aims to gain graphical richness over time.

Altogether, the thought is that these two tracks will continue to evolve and eventually meet in the middle. The question is which track gets there first... and when the convergence point will happen. Speaking to the latter question, it likely won’t be in this decade but it will be a powerful tipping point for XR when it does happen. We’ll pick things up there in the next section with the all-important question of *when?*

Image Source: Meta

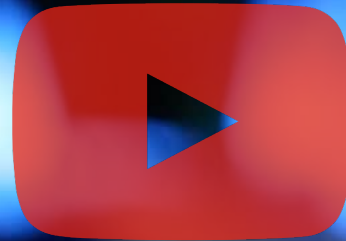


“VR developers who want to offer mixed reality features or ‘MR modes’ in their games will be attracted to platforms that offer that capability, putting others at a disadvantage.”

*disadvantage,”
putting others at a
that capability
platforms that offer
advantage.”*

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VR Revenue Outlook

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Final Thoughts: The Long Run

Full Circle

Aside from the previous section on the metaverse, most of this report has focused on the present and near-term outlook for spatial computing. But what about the longer-term future? Indeed, when talking about emerging tech, the discussion should include both short and long-run perspectives.

That brings us full circle to spatial computing's lifecycle, examined in this report's introduction. As part of that lifecycle, one key lesson learned after the circa-2016 period of elevated XR hype is that it's ill-advised to set overblown expectations. Many companies and investors got burned from believing that AR and VR's revolutionary impact was much larger and more imminent than it was... an expensive miscalculation.

Cautionary Tale

Consumers have also been turned off to some degree by this hype cycle. That's not because these technologies aren't compelling, but because they've been disappointing relative to their hyped promises. Magic Leap's first headset is one example of this sequence... and the company has paid dearly for it.

With that backdrop, what's the timeline for fully actualized AR and VR? For example, when will we get all-day AR glasses that offer both graphically robust UX and stylistic viability? That combination isn't possible today due to the technological realities and tradeoffs examined earlier in this report.

The consensus is that these goals will be reached sometime in the 2030s. For example, Snap CEO Evan Spiegel is one executive who's been realistic about this longer time horizon in his public statements. Meta CEO Mark Zuckerberg has also begun to publicly acknowledge this reality.

Image Source: Apple



One key lesson learned after the circa-2016 period of elevated XR hype is that it's ill-advised to set overblown expectations. Many companies and investors got burned."

Final Thoughts: The Road to 2030

Full Effect

To further underscore these sentiments from AR leaders, we've collected some of their public statements. Here they are for full effect:

Mark Zuckerberg on The Information Podcast.

"When we got phones, we didn't get rid of our computers. We maybe just shifted some of our time toward phones. My guess is that we'll have phones for a while too, so that part of what we do will always be important. But I think over time, [AR] will become the platform for more and more people, and I think there's a lot of awesome stuff that comes from that. If you can deliver a computing platform that's fundamentally more human and about creating natural interactions between people, that's sort of the dream that we've been chasing for a long time. If we can build that — and I do think it will be in a decade — a lot of the things we've talked about today should be delivered and at scale. I think that that will be very exciting. A lot of this stuff will start to come about in the 2020s. It may not really reach the full scale until 2030."

Evan Spiegel at TechCrunch Disrupt

"Spectacles represent a long-term investment in augmented reality hardware. [...] So I think it'll be

roughly ten years before there's a consumer product with a display that could be really widely adopted. But in the meantime, we've built a relationship with our community and all these people who love building [AR] experiences and we're sort of working our way toward that future, rather than go in a hole or in an R&D center, and try to make something that people like, then show them ten years later. We've sort of created a relationship with our community where we build that future together."

Image Source: TechCrunch



"If you can deliver a computing platform that's fundamentally more human and about creating natural interactions between people, that's sort of the dream that we've been chasing."

Final Thoughts: Realistic Expectations

Signature Schadenfreude

Though the road to “all-day” AR glasses is long and winding, there are meaningful wins along the way. The two tech leaders on the previous page helm companies that are achieving such milestones, including user engagement and real revenue in areas like AR brand marketing and consumer VR sales. But that’s not often the story told in the signature schadenfreude of the tech press.

These short-term wins from the likes of Snap and Meta fuel their ability to speak honestly about the long term. They can temper expectations for AR glasses while armed with the confidence that the spatial computing work they’re doing today is producing tangible and financial – albeit gradual – results.

Easier to Swallow

Put another way, these short-term results make the 2030s deferment of AR’s fully-actualized self easier to swallow. And the sooner we all come to terms with

that, – including generalist tech articles that still parade AR glasses’ and VR headsets’ world-changing impendence – the more we’ll set these technologies up to succeed through realistic expectations.

Image Source: Meta



“Snap and Meta can temper expectations for AR glasses while armed with the confidence that the work they’re doing today produces tangible and financial – albeit gradual – results.”

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ARtillery Intelligence chronicles the evolution of spatial computing (AR & VR). Through writings and multimedia, it provides deep and analytical views into the industry's biggest players, opportunities, and strategies.

Run by analysts and former journalists, coverage is grounded in a disciplined and reportorial approach. It also maintains a business angle: Though there are fun and games in spatial computing, cultural, technological, and financial implications are primary.

Products include the *AR Insider* publication and the *ARtillery PRO* research subscription, which together engender a circular flow of knowledge. Research includes monthly narrative reports, market-sizing forecasts, original consumer survey data, and multimedia – all housed in a robust intelligence vault.

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“Though there are fun and games in spatial computing, cultural, technological, and financial implications are primary.”



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Briefings

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About the Author

Mike Boland was one of Silicon Valley's first tech reporters of the Internet age as a staff reporter for *Forbes* (print) starting in 2000. He's been an industry analyst covering emerging and immersive tech since 2005; and is now Chief Analyst of ARtillery Intelligence and Editor of *AR Insider*.

Mike is a frequent speaker at industry conferences such as AWE, XRDC, Lens Fest, and the VR/AR Global Summit. He has authored more than 150 reports and market-sizing forecasts on the tech & media landscape. He contributes regularly to news sources such as TechCrunch, Business Insider, and Huffington Post.

A trusted source for tech journalists, his comments have appeared in A-list publications, including *The New Yorker*, *The Wall Street Journal*, and *The New York Times*.

Further background, history, and credentials can be read [here](#).

Methodology



This report highlights ARtillery Intelligence viewpoints, gathered from its daily in-depth market coverage. To support narratives, data are cited throughout the report. These include ARtillery Intelligence original data, as well as that of third parties. Sources are linked or attributed in each case.

For market sizing and forecasting, ARtillery Intelligence follows disciplined best practices, developed and reinforced through its principles' 18 years in tech-sector research and intelligence.

This includes the past 8 years covering AR & VR exclusively, as seen in research reports and daily reporting.

This approach primarily applies a *bottom-up* forecasting methodology, which is secondarily vetted against a *top-down* analysis. Together, confidence is achieved through triangulating revenues and projections in a disciplined way.

More about ARtillery Intelligence's market-sizing methodology can be seen [here](#) and more on its credentials is [here](#).



Disclosure & Ethics Policy

Unless specified in its [stock ownership disclosures](#), ARtillery Intelligence has no financial stake in the companies mentioned in its reports. The production of this report likewise wasn't commissioned. With all market sizing, ARtillery Intelligence remains independent

of players and practitioners in the sectors it covers, thus mitigating bias in revenue calculations and projections. ARtillery Intelligence's disclosures, stock ownership, and ethics policy can be seen in full [here](#).



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