

Virtual Reality and Augmented Reality: Using Immersive Technologies for Digital Transformation, Customer Experience and Innovation

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Application leaders should educate their business partners on the use of immersive technology (virtual reality, augmented reality and mixed reality) to achieve business outcomes and shift to a multiexperience mindset. Focus on specific use cases that will impact digital transformation immediately.

Key Challenges

- Lines of business (LOBs) and application leaders are challenged with aligning immersive technology use cases (employee or consumer-facing) with different implementation approaches (augmented reality, virtual reality or mixed reality).
- Application leaders find developing and deploying immersive technologies are more complex than initially thought especially due to the unique user experiences immersive technologies require.
- Besides development and deployment best practices, application leaders are not clear what other factors (e.g., content management, storytelling) need to be considered for implementing immersive technology.

Recommendations

Application leaders responsible for development strategies for digital business must:

- Prioritize and develop their immersive technology advice and use cases by showing how these technologies can support or amplify specific business outcomes.
- Start by leveraging existing mobile app development teams, as they are the logical choice to deliver immersive technology solutions. The mobile app development teams will, however, need help from subject matter experts.

- Implement best practices for app development (including agile and DevOps) while focusing on the intrinsic requirements of different types of immersive technology experiences, including unique user experiences, 3D content creation and interacting virtual objects with the real world.

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Strategic Planning Assumption

By 2022, 70% of enterprises will be experimenting with immersive technologies for consumer and enterprise use but only 15% will have deployed to production.

Introduction

When discussing immersive technologies, specifically mixed reality, the term "infinite display" is a good descriptor of what immersive technologies really are and could mean to organizations. Organizations now have the ability to provide users (such as employees, customers and suppliers)

with a means to obtain real-time information, experience virtual environments and engage in social collaboration beyond a limited 2D display and limited point of view.

Consumers are already experiencing these technologies, often without even knowing it. Snapchat filters, augmented reality features in retail mobile apps and 360-degree video and photos on Facebook and YouTube are all forms of immersive technology that have been integrated into aspects of the most successful consumer mobile apps. These app experiences are all achieved without the need for head-mounted displays (HMDs); however, combining HMDs with immersive technology adds a more immersed, engaging and often hands-free experience that truly creates an "infinite display."

There is confusion as to what these technologies really are and how they differentiate from each other. To be clear, and in the context of this note, we will define immersive technologies as:

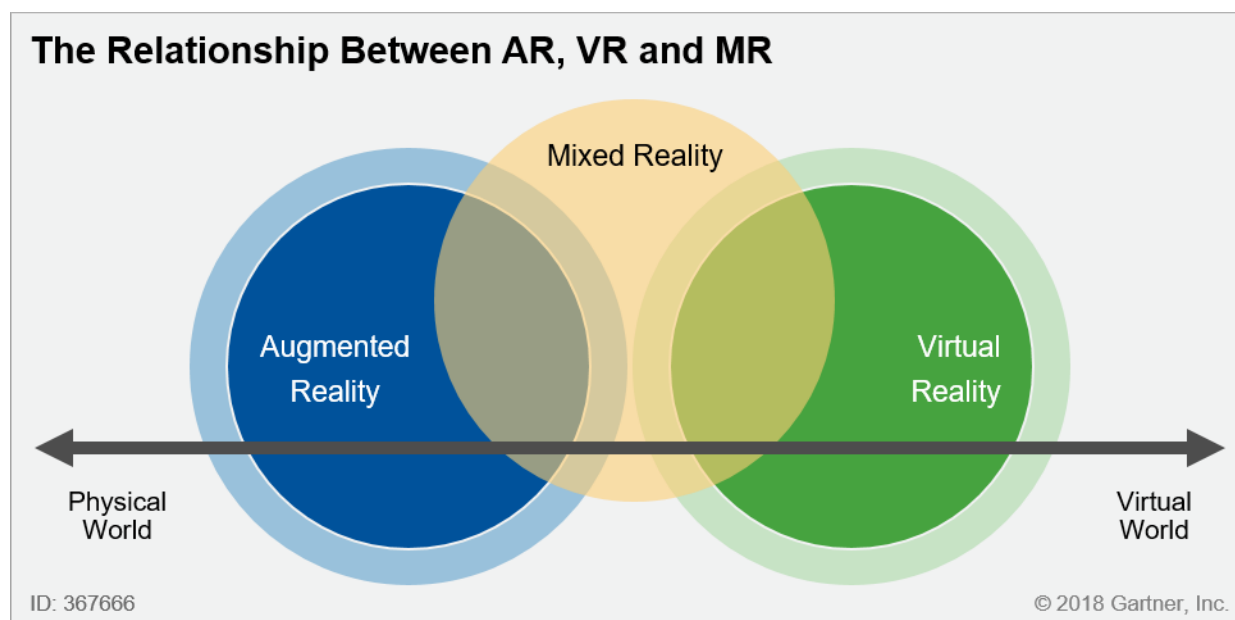
Virtual reality (VR) — Computer-generated (digital) environments to fully immerse users in a virtual "world."

Augmented reality (AR) — Overlaying digital information on the physical world with no or very limited interaction with virtual objects.

Mixed reality (MR) — A blend of the physical and digital worlds in which users may interact with digital and real-world objects while maintaining presence in the physical world.

This note will discuss how each of these technologies will fit into the overall digital transformation strategy in organizations (see Figure 1).

Figure 1. The Relationship Between AR, VR and MR



Source: Gartner (July 2018)

Across this continuum of immersive technologies, it is important to note that each provides solutions for specific use cases. While there is common ground for how the technologies could be used (devices, tools, technologies and methodologies), it is important for organizations to focus on the uniqueness of each in order to provide the most valuable and applicable experience for their use cases.

Analysis

Prioritize and Develop Your Immersive Technology Use Cases Based on Your Business Goals and Drivers

There is great difficulty in verbally describing what an immersive experience is like to someone who has not experienced it. Without experiencing and using them on a regular basis, AR/VR technologies are difficult to understand and master. If someone hasn't experienced these technologies, they may start making incorrect assumptions about them as well. Also, AR and VR are very different experiences and should be considered separately. This makes the job of LOBs or application leaders that much more difficult. How can they embrace and effectively deploy immersive technologies when there are knowledge and experience deficits?

Options for experiencing these technologies are emerging and range from such smartphone-based devices as Samsung Gear VR to less-capable devices like Google Cardboard and VR HMDs that are tethered to a PC or video game console like the PlayStation VR to such stand-alone untethered devices as Oculus Go. Getting started with experiencing and experimenting with immersive technologies could be accomplished with little investment. AR, for instance, can be experienced on a handheld device (such as a smartphone or tablet) via some consumer apps (such as Pokémon Go) that are using AR-like features to their advantage. Other AR solutions use an HMD (e.g., in glasses or a helmet) form factor (such as RealWare HMT-1, ODG R-8 and Epson Moverio). True MR experiences are extensions of AR that blend the real and virtual. Few examples of these types of devices exist, Microsoft HoloLens being a notable exception.

Business strategies and goals should drive the decision to consider immersive technology to target specific business outcomes that could be determined with help of enterprise architects (see "Use Enterprise Architecture to Orchestrate the Delivery of Business Outcomes"). Ask, "Is there a specific business outcome that could take advantage of something intrinsic to immersive technology?"

Is there a specific business outcome that could take advantage of something intrinsic to immersive technology?

For organizations considering use cases across the spectrum, Table 1 provides an overview of the types of immersive technologies that have proved of value to other organizations.

Table 1. Immersive Technology Use Cases

Industry	Category	Example Use Case
Consumer Packaged Goods	New Marketing Channels	VR: The Coca-Cola Co. provided customers with a virtual experience as part of an international marketing campaign. ¹
Automotive	Sales and Demos	VR: Volvo provided potential customers with the opportunity to test-drive its cars — virtually. ²
Commercial Sector (Mining)	Training and Simulations	VR: QinetiQ creates realistic virtual environments that simulate the harsh conditions in a mine for training purposes. ³
Manufacturing	Manufacturing Environments	AR: PTC is helping manufacturers to overlay real-time machine health and maintenance information. ⁴
Medical	Medical and Surgery	AR: Surgeons are using an AR-equipped camera to project their hands into the arthroscopic field of the residents who are in the operating room for training and real-time collaboration. ⁵
Manufacturing	Field Service Collaboration	AR: Fieldbit provides hands-free real-time AR visual collaboration with remote experts on complex machinery fixes. ⁶
Construction	Design Collaboration and Visualization	MR: Architects and designers can collaborate in real time to make instant changes to designs and plans with the Microsoft HoloLens. ⁷
Education	Education and Exploration	MR: 3D4Medical's Project Esper offers students a way to interact with and learn anatomy in an MR environment. ⁸
Digital Workplace	Office and Workspace	MR: Magic Leap demonstrates how to turn an office, table or desk into an interactive visual display. ⁹
<p>1 "International Ad Spotlight: A Christmas Wish Comes True in Coca-Cola Brazil's 'A Bridge to Santa.'" Coca-Cola.</p> <p>2 "Presenting Volvo Reality." Volvo.</p> <p>3 "Virtual Reality Training." QinetiQ.</p> <p>4 "How Augmented Reality Tames IoT Information Overload." Forbes.</p> <p>5 "The Emergence of Augmented Reality in Orthopaedic Surgery and Education." The Orthopaedic Journal.</p> <p>6 "Augmenting Enterprise Knowledge." Fieldbit.</p> <p>7 "Architect Uses Microsoft HoloLens to Design Buildings." YouTube.</p> <p>8 "Project Esper: Mixed Reality Anatomy Learning." YouTube.</p> <p>9 "Just Another Day in the Office at Magic Leap." YouTube.</p>		
AR = augmented reality; VR = virtual reality; MR = mixed reality		

Source: Gartner (July 2018)

As demonstrated in the table above, immersive technologies are useful for a wide array of use cases. There are, however, many types of immersive experiences and trying to find a one-size-fits-all solution for your project, product or overall immersive strategy will not work. Starting by defining a specific use case is essential. That particular use case will point to many of the tools, technologies, methodologies and resources required.

Recommended Action

Application leaders should collaborate with LOB leaders and enterprise architects to determine a use case, based on a defined business outcome, to start with. The use case should be clearly defined. Defining the minimum amount of functionality that internal and external customers will find useful (referred to as the "minimum viable product" [MVP]), which is nothing new to app development (see "Successful Mobile App Projects Need Empowered and Agile Product Owners"), will be enough.

Leverage Existing Mobile App Development Teams

Mobile devices are currently at the center of the implementation of many immersive technologies. For example, AR is inherently mobile and most of the successful use cases are achieved with the use of a mobile phone or tablet. AR has been a key feature and area of promotion in both Apple and Google's marketing efforts for their new devices and OS releases based on their built-in AR frameworks ARKit and ARCore, respectively (see "The Impact of Google and Apple on Mobile AR Development").

Furthermore, from a VR perspective, many of the solutions are achievable with a mobile phone and an HMD accessory (such as Daydream by Google, Samsung Gear VR or Google Cardboard). This is not to imply that all use cases could be optimized using a mobile device, but it is a great place to start (see "Getting Started Developing Virtual Reality Experiences").

Development Tools

Beyond ARKit and ARCore, there are many software development kits (SDKs) and tools that allow users to extend mobile applications with immersive technology capabilities. One example is Wikitude, which has an SDK that provides image recognition and tracking as well as geolocation capabilities for the use of AR in mobile applications (see "Market Guide for Augmented Reality").

Many SDKs could be implemented directly within the mobile application development platforms that application teams are already using. Whether it be native tools (such as Xcode) or cross-platform tools (such as Xamarin), SDKs provide the ability to add immersive technology capabilities.

Additionally, mobile application development teams that are already leveraging JavaScript and C# to develop mobile apps will find that those skills are transferable to immersive technology development platforms. Specifically, application leaders may want to begin looking at expanding their mobile application development toolkits to include game engines (such as Unity and Unreal Engine) and design technologies. Many of the use cases, especially deeply immersive VR experiences, are best developed in such game engines as Unity. VR applications share many of the

same components (assets, workflow and deployment) as video games and, in fact, many of the advancements seen in VR come directly from the game industry.

Experts and Education

Success with immersive technology initiatives takes much more than just adding the tools to an existing workflow. Therefore, bringing in or outsourcing subject matter experts (SMEs) — at least for initial projects — is highly recommended. Immersive technologies provide unique experiences that require a deep understanding of specific requirements and best practices. Although these best practices often evolve and are the result of lessons learned, outsourcing SMEs with direct experience in immersive technologies and getting them to work with mobile application development teams is the right way to go.

There is no substitute for development teams experiencing the use of immersive technologies.

The development of immersive technologies is still nascent. Finding expertise may be difficult because qualified resources may be few in number. Application leaders will need to expand the skill set of their existing mobile application teams to include these new technologies either through, or in combination with, training, hiring and outsourcing. Furthermore, there is no substitute for development teams experiencing immersive technologies. If they haven't experienced the technology, they won't know how to develop effective immersive solutions.

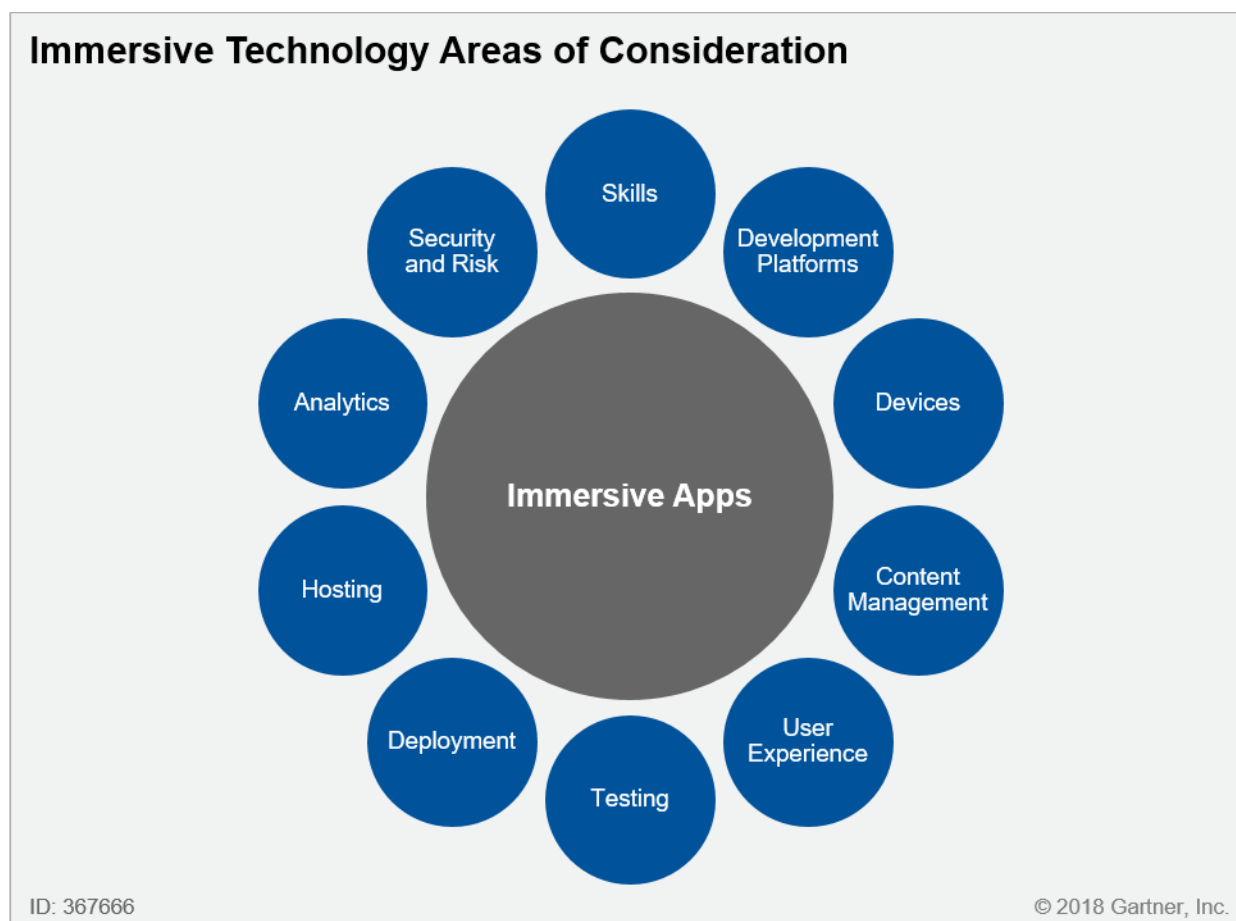
Recommended Action

App leaders should use the initially defined use case or the MVP to determine the skills needed, estimated costs and existing gaps with the existing mobile app development teams and tools (see "How to Estimate Mobile App Development Costs"). Bringing in a subject matter expert to help lead this initial project will be imperative, as they will have the best knowledge and experience as to what is needed (additional tools, user experience, narration, etc.) while also providing guidance for preparing for future iterations and experiences that ultimately will be developed in-house.

Implement Best Practices for App Development While Focusing on the Intrinsic Requirements of Immersive Technology Experiences

At a high level, immersive technology applications should follow the best practices that apply to any modern digital application. Although immersive technologies require specific tools and methodologies, the areas of consideration are common across the application portfolio. Figure 2 provides an overview of these areas.

Figure 2. Immersive Technology Areas of Consideration



Source: Gartner (July 2018)

Content Management — Content is key to any immersive technology solution. Whether it is 3D-generated content to create a virtual environment or actionable information used as an overlay in an AR solution, content is the focus of the immersive experience. Focus on content creation (i.e., Maya, Blender, Sumerian), consumption and management because immersive technology requires unique creation skills and toolsets, diverse means of consumption and quality management. Content for immersive technologies raises its own storage and delivery challenges on which architects will need to collaborate with others in order to implement content delivery network solutions.

Testing — While you may be able to leverage existing app testing principles and processes, testing for immersive technology is more like testing a video game than it is a traditional app. Focus efforts on optimizing the user experience through manual testing, and possibly crowdsourcing, of the immersive parts of the app.

Deployment — Mobile-based immersive technology applications could follow similar deployment models as enterprise apps (enterprise app stores) and consumer-facing apps (public app stores). However, platform-specific applications require separate deployment avenues and restrictions (that

is, the ability to deploy employee-facing apps) for each platform, as they will have platform-specific stores and deployment models.

Skills — Some skills and technologies could be leveraged from mobile application development teams, but plan for ongoing education and skills improvement in the area of immersive technology. Teams need to explore how to utilize game engine and design methodologies. Also, immersive technologies have unique functional and nonfunctional requirements that may require subject matter expertise for content creation, computer vision, head tracking and user interface design.

Devices — Immersive technologies may be deployed on myriad devices, including phones, tablets, desktops and various HMDs. Understanding where specific use cases fall on the continuum (AR, VR or MR) will help in determining which types of devices should be explored. For example, 360-degree video may be achievable via Google Cardboard, but complex MR solutions may require Microsoft HoloLens or smartglasses from ODG.

Development Platforms — Particular SDKs and platforms are being made available at a rapid rate for immersive technologies. Application teams need to discuss their requirements with existing platform vendors and determine if support for immersive technologies will be integrated into their platforms. This should also be a part of the conversation for development platform decisions in the future. Most likely, additional game platforms (such as Unity and Unreal Engine) may be required to add to the development toolbox. Other technologies and platforms to consider are computer vision, head tracking and conversational interfaces.

Security and Risk — Like any application initiative, bringing in security and risk team(s) early on in the conversation is recommended. Some specific items to keep in mind include privacy, device management and content and data security as well as capabilities to record and track user behavior.

Analytics — Immersive technologies offer unique user experiences and, therefore, may require unique analytics. These analytics may include human body performance, user interface elements, responsiveness and 3D interactions. This will be an area that will continue to grow and expand as these capabilities are added to existing tools and new players (for example, cognitive3D) emerge in this area. As with any application, behavioral and operational analytics should be considered.

Hosting — Given the importance of content, processing computer vision and deep learning, and the myriad device platforms, understanding hosting solutions that uniquely support immersive technologies (for example, InstaVR, 360RIZE, Amazon Rekognition) will become increasingly important.

User Experience — Developing an enjoyable and effective user experience within the unique environments and devices for immersive technology could easily make or break the solution. This includes the UI, environments, assets, interactions, storytelling and overall flow and processes. It includes as well such items specific to immersive experiences as registration (correct alignment of virtual objects with the physical environment), user agency (the ability of users to control their environment) and presence (the sense of "being there"). This is where bringing in an SME would be important. Application leaders need to make this a priority.

Recommended Action

These 10 areas of consideration should be nothing new to organizations that are already successfully deploying applications. Application leaders should not try to deal with all of these solutions by themselves or even by using siloed development teams. Input from across the organization, facilitated through enterprise architects and possibly via a broader digital design center of excellence, is recommended (see "CIOs Should Balance Digital Design Centers and Digital Design Centers of Excellence").

Gartner Recommended Reading

Some documents may not be available as part of your current Gartner subscription.

"Best Practices for Using Augmented Reality in Mobile Apps"

"Top 10 Strategic Technology Trends for 2018: Immersive Experience"

"Research Roundup: Augmented Reality and Virtual Reality"

"How Virtual Assistants, Immersive Experiences and Robots Will Impact Your Organization"

"Examine 4 Use Cases for Augmented Reality Apps in the Enterprise"

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