

Investment Spotlight

September 2021

Each quarter we highlight an investment theme from the Disruptive Innovation Strategy, focusing on the megatrends driving disruption and the companies we believe are best positioned to capitalize. Companies mentioned in this series should not be perceived as specific stock recommendations.



Welcome to the Metaverse

Investment Opportunities in Virtual and Augmented Reality

Introduction

One of the biggest challenges of investing in disruptive innovation is separating emerging trends from fads, and identifying which companies ultimately will benefit if the technology scales. Such is the case with our latest investment theme, the Metaverse. The Metaverse can be thought of as an expanded form of Virtual Reality (VR), where technology is used to trick the senses into believing you have been transported to another world. Today, VR typically is associated with video games projected onto VR goggles, but the Metaverse is a much bigger idea. It incorporates advanced technologies like spatial audio, tactile feedback from sensors and photorealistic imagery, allowing the user to participate in virtual “experiences” which are realistic enough to invoke a heightened sense of “presence”. The shared sense of community within such *purposefully designed* environments has the potential to unlock new and disruptive business models. We have seen this story before in the case of digital advertising. Early news-aggregation websites such as Yahoo! used clickable images to entice users to buy products and services from advertisers. Google and Facebook took it to a higher level by offering useful services for free and targeting users with tailored advertisement. The shared virtual experiences being developed for the Metaverse take engagement to a completely new level and have the potential to influence how we communicate and learn, how products are designed and manufactured, and how we spend our free time with family and friends. Advertising certainly will play a role, as we describe in an example below, but the building blocks and early demonstrations of the Metaverse point to disruptive innovation in many facets of our lives, as work and play shift to immersive 3D virtual environments.

Inspiration for the Metaverse as a fully formed virtual world came from science fiction novels dating back to the early 1990’s¹, shortly after the World Wide Web was invented. Despite recent technological advances in mobile computing and artificial intelligence (AI), it still is expected to take a decade or more to fully realize the vision. Proprietary versions under development today are expected to coalesce over time into a single, standards-based Metaverse, where users can freely roam from one virtual experience to the next, taking their

¹ *Snow Crash*, by Neal Stephenson (1992), and *Ready Player One*, by Ernest Cline (2011)

digital assets with them. It is unlikely a single company will own or control the Metaverse, but it is clear that certain companies are better positioned than others to capitalize on it, and to influence how it unfolds. In this note, we describe three such companies, starting with Roblox, which describes itself as a Metaverse gaming company. Over 46 million people visit Roblox daily² to engage in thousands of virtual experiences created by their developer community, which ultimately generated over \$2.4 billion in revenue for the company over the last year. The second company is NVidia, a leading graphics chipset designer with products that are used extensively in artificial intelligence (AI) and machine learning (ML) applications. In April of this year, NVidia introduced its Omniverse Platform, allowing companies such as BMW, to design “digital twin” representations of factories, and Ericsson, with a way to simulate 5G wave propagation. NVidia’s products are expected to play a key role in bringing photorealistic visual experiences to the Metaverse, as well as the underlying intelligence to make it productive. The last company is Facebook, whose CEO recently described his ambition for Facebook to become a “Metaverse company”³ by leveraging over 7 years of investment in its Oculus line of VR goggles and its global community of 2.9 billion users⁴. It recently rolled out a VR-based collaboration tool for enterprises, called Horizon Workrooms, which goes well-beyond simple video conferencing.

Roblox

Roblox is a Massive Multiplayer Online (MMO) game that was launched in 2004 by co-founders David Baszucki and Erik Cassel. The game is free to play but generates revenue by offering in-game purchases using its virtual currency, Robux, for items like cars and skins to use within virtual *experiences*. In the June 2021 quarter, the company reported daily user growth of 29% YoY and revenue growth of 127% YoY on the platform. The most distinguishing feature of Roblox is that it is a *user-generated* gaming platform, akin to YouTube for video, offering powerful, but free tools to create experiences for others to play. When in-game purchases are made, Roblox and the developers split the revenue. Such a model does not exist in other major MMO’s like Fortnite or Minecraft, which charge users both to play and to purchase items within the game. With the Roblox model, players and developers become *invested* in their creations, which over time has led to higher levels of engagement and greater revenue per user.



Lil Nas X concert on Roblox was visited over 33 million times

² As of July 2021

³ <https://www.platformer.news/p/-mark-in-the-metaverse>

⁴ https://s21.q4cdn.com/399680738/files/doc_financials/2021/q2/Q2-2021_Earnings-Presentation.pdf

Historically Roblox has appealed to a younger demographic (under 13 yrs old), but in 2016 the company made a concerted effort to revamp its monetization model, including introducing Robux, to appeal to an older cohort of gamers. For example, the company has hosted in-game concerts with popular artists like Kanye West and Lil Nas X, and introduced innovative ad campaigns like the Gucci Garden, where the company created an environment in which to visit, learn about products and buy digital versions of Gucci handbags (for real money). User growth has accelerated from these efforts and the user base gradually has shifted to an older demographic. When the pandemic hit, its user base exploded, with daily users doubling, and the money spent on Robux nearly tripling over the prior year, resulting in Roblox’s market cap increasing to nearly \$50 billion.



Gucci Gardens ad-campaign inside Roblox
Source: https://roblox.fandom.com/wiki/Gucci_Garden#Game

Roblox today has many of the key enablers for a future Metaverse: a fully formed set of game development tools, which are accessible to novices, an in-game payment system, and a marketplace for ancillary content and services. A platform like Roblox could become an ideal use case for new VR technologies such as the immersive displays of Magic Leap⁵ or the haptic feedback suits of VR Training Ltd⁶, which today are being used in industries ranging from healthcare to manufacturing. One important missing piece, however, is a set of open industry standards linking the worlds of Roblox, Fortnite, and Minecraft together, which will be needed for users to move freely across the Metaverse. Interestingly, this issue has an analogue in the real world of software simulation, and a potential solution in the form of NVidia’s Omniverse Platform.

NVidia Omniverse

NVidia is the most valuable semiconductor company today, and the recognized leader in silicon chips used in computer-generated graphics, cryptocurrency mining and most importantly AI, where its latest architecture, Ampere, is used by virtually all major cloud computing companies. In 2018, it introduced a new generation of graphics cards, which produced stunningly real computer-generated images and video. AI algorithms were used to sharpen low-resolution scenes in order to produce life-like imagery, and high frame rates were used to make the rendered scenes seem natural. In 2020, it combined elements from its gaming and AI technology to introduce a new platform called the Omniverse Real-Time Collaboration Platform⁷, serving as the common “plumbing” for 3rd party design software packages from vendors such as Autodesk and Dassault to work together.

⁵ <https://www.magicleap.com/en-us>

⁶ <https://teslasuit.io/the-suit/>

⁷ <https://www.nvidia.com/en-us/omniverse/>

NVIDIA's Omniverse platform has three main components. Nucleus allows software tools from different vendors to use common definitions for the properties of 3D objects including shading, lighting, and animation. A physics engine defines the physical and kinematic properties of objects in a consistent way. Lastly, AI is used both to train and to deploy simulated robots using machine learning algorithms. The end result is an open, feature-rich collaboration platform where software from different vendors can come together to create digital representations, called "digital twins" which can be fully optimized and validated prior to construction. BMW is using the Omniverse platform for factory planning in its production network, including training of autonomous robots, predictive maintenance and data analytics⁸.

Current pricing of NVIDIA's Omniverse platform is \$1,500/user/year plus upwards of \$250,000 to license the Nucleus server⁹. At a current revenue run rate of more than \$27 billion/year it will take quite a while before Omniverse contributes in a material way to NVIDIA's revenue, but advancements in graphics and AI clearly will benefit future versions of the platform. As the utility of the Omniverse is proven, and more companies undertake collaborative design virtually, we believe the incentives will be strong for more design software packages to interoperate with the Omniverse platform, taking a significant step closer to a singular Metaverse based on common industry standards.

Facebook

When Facebook acquired Oculus, maker of virtual reality goggles, in 2014, the view at the time was that Facebook was targeting the gaming market to augment its highly successful digital advertising business. Early versions of the Quest VR goggles required a direct connection to a powerful gaming PC, and there were few titles available, so it never really developed into a successful product. But Facebook had other ideas for VR. Like Roblox, Epic, NVIDIA and others circling the Metaverse opportunity, it knew that user behavior changes gradually, and in order to take the initial steps into a virtual world people will need some type of incentive. In August of 2021 Facebook introduced a new software application called Horizon Workrooms, leveraging its second-generation Quest VR goggles and a host of core technologies needed to make the Metaverse a useful experience. In Facebook's words:

"Workrooms brings some of our best new technologies together for the first time into one experience on Quest 2. Using features like mixed-reality desk and keyboard tracking, hand tracking, remote desktop streaming, video conferencing integration, spatial audio, and the new Oculus Avatars, we've created a different kind of productivity experience."

- Facebook blog entry "Introducing Horizon Workrooms: Remote Collaboration Reimagined"
<https://about.fb.com/news/2021/08/introducing-horizon-workrooms-remote-collaboration-reimagined/>

Early reviews have been very positive^{10 11} noting the increased feeling of presence compared to video conferences by incorporating spatial audio, hand gestures and facial expressions from avatars in the room. Workrooms also serves as a forerunner to the long-awaited Facebook Horizon multi-player VR playground. Perhaps most important for Facebook, noting its struggle with Apple on several fronts, is that it shifts users' attention away from mobile devices towards a new 3D-immersive environment where newer, richer experiences are possible.

⁸ <https://bimmerlife.com/2021/04/17/bmw-using-nvidia-omniverse-for-virtual-factory-planning/>

⁹ <http://www.cgchannel.com/2021/04/nvidia-announces-omniverse-pricing/> ¹⁰ Facebook gets VR meetings right with Horizon Workrooms. <https://www.engadget.com/facebook-horizon-workrooms-oculus-vr-meeting-collaboration-110018369.html>

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¹¹ Enterprise Metaverses, Horizon Workrooms, Workrooms' Facebook Problem, <https://stratechery.com/2021/enterprise-metaverses-horizon-workrooms-workrooms-facebook-problem/>

Conclusion

Early science fiction novels such as Snow Crash and Ready Player One provided inspiration for a generation of engineers to create the technologies described in this note, which are just now coming to fruition. From an investment standpoint, we recognize it will take time for the full vision of the Metaverse to be realized, and so our focus is on those companies with complementary businesses that we believe will be successful, regardless of timing. Roblox, and open-world games like Fortnite and Minecraft, which collectively have well over 100 million daily users, are probably the best representations of what gaming might look like in the Metaverse. Noting that Epic Games, publisher of Fornite, is a private company, and Minecraft is a small part of Microsoft, Roblox is, in our view, the best pure-play public investment opportunity in the space. NVidia appears to be particularly well positioned to provide the computing infrastructure underpinning the Metaverse, and has introduced the Onmiverse platform combining the best parts of 3D graphics and AI for collaborative design. It will take time to move the needle in terms of revenue, but the platform has gained immediate traction from major companies like BMW, Ericsson and Industrial Light and Magic¹², and there do not appear to be any factors in terms of research and development which are holding it back. At this point it seems to be a question of user behavior and the rate of adoption, which ultimately will be governed by the ability of customers to derive value from the platform. Lastly, Facebook has introduced its take on video conferencing with the Horizon Workroom using VR goggles and a host of technologies to empower virtual avatars. It is telling that a social network of 2.9 billion people chose a product targeted at business users for its first release. As the price of VR technology comes down, and interest grows, we believe Facebook will be very well positioned to connect users in a virtual world.

¹² <https://blogs.nvidia.com/blog/2020/05/14/omniverse-early-access/>



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