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A Descriptive Study on Metaverse:
Cybersecurity Risks, Controls, and Regulatory Framework

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ABSTRACT

Maximalist, interconnected set of experiences straight out of sci-fi, based on 3D virtual environment through personal computing, and augmented reality headsets—a world known as the Metaverse—this is the futuristic vision of internet that technology giants are investing in. There has been some research on data privacy risks in the metaverse; however, detailed research on the cybersecurity risks of virtual reality platforms like metaverse have not been performed. This research paper addresses this gap of understanding the various possible cybersecurity risks on metaverse platforms. This study tries to understand the risks associated with metaverse by describing the technologies supporting metaverse platform and understanding the inherent cybersecurity threats in each of these technologies. Further, the paper proposes a cybersecurity risk governance regulatory framework to mitigate these risks.

KEYWORDS

Augmented Reality, Cybersecurity, Metaverse, Mixed Reality, Privacy, Virtual Reality

INTRODUCTION

The famous global news website quartz defines metaverse as an immersive next-generation version of the internet, rendered by virtual or augmented reality technology (Nover, S., 2021.). Internet has evolved over the years, having transitioned from internet on desktop to web and now on mobile phones. Information transfer has also evolved from text to sharing photos to watching video content, with Web 1.0 - read only, Web 2.0 focused on person-to-person connection, Web 3.0 will be decentralized and focused on user interaction and will limit and control users' content (Nath, K., Dhar, S. and Basishtha, S., 2014). The next frontier in internet evolution is the metaverse, where you feel virtually present. While virtual reality has been classified for a while now, as one of the emerging technology trends used for gaming and virtual experiences, it differs from metaverse, since metaverse will be more immersive, embodied internet where you are in the experience, be it getting together with family, play, work or at shopping. The recent entry of some of the biggest technology firms into metaverse has

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sparked the debate among the tech world and the general public on the relevance, risks, and benefits of such online platforms, after the moderately successful earlier attempts to create such platforms eg: Second life (Heath, Dan & Chip., 2011).

18 years after the first release of Second life in 2003, technology firms are reinvesting in virtual reality platforms. What has changed since then? It can be argued that technology has made great progress, especially average internet speed has increased from 64 Kbps to over 1 Gbps with the 5G networks (Vora, L.J., 2015.). There have been significant advances in supporting technologies such as 5G/6G networks, artificial intelligence, IoT, graphics and robotics. Also about 60% of the world's population now have access to internet (Johnson, Joseph, 2021). All these advances have made it much more conducive for the emergence of such virtual platforms, which is promised to be much more realistic and present than earlier. Research is still ongoing to better some of the components of metaverse for eg: VR supporting infrastructure including hardware such as VR headsets that have sensors to allow avatars to mimic real-world movements, which would make the VR experience much more lifelike. The metaverse would feature a marketplace for goods both physical and virtual items owned by avatars and implemented as NFT's (non-fungible tokens). Metaverse would have other multitude of applications which is described in section 1.3.

The venture capitalist Matthew Ball, whose writing on the metaverse has influenced Mark Zuckerberg, describes in his article on the metaverse that "future solutions are often understood and, in a sense, agreed upon well in advance of the technical capacity to produce them. Still, it's often impossible to predict how they'll fall into place, which features matter more or less, what sort of governance models or competitive dynamics will drive them, or what new experiences will be produced" (Ball, M.,2020). As Matthew described, there are still many issues relating to metaverse which needs to be discussed and one of them is the security and privacy risk as well as perceived risks to this platform and a control governance model to mitigate these risks. These are researched and discussed in the following sections.

Basic Concepts of Metaverse

In order to understand the technology risks associated with Metaverse and to formulate a technology governance model, it is first important to gain familiarity with the main concepts of Metaverse. These eight concepts listed below essentially summarize the metaverse experience and also helps with perceiving the technology risks associated with the underlying technologies:

1. **Avatar:** Living 3D representations of the users and user expressions. One can have different avatars for work, gaming and for hanging out. Modular Codec Avatars (MCA) generates hyper-realistic faces driven by the cameras in the VR headset. MCA extends traditional Codec Avatars (CA) by replacing the holistic models with a learned modular representation (Chu, Hang, et al.). Technology companies are bettering perceptual science to ensure the avatars feel real and present. Also it needs to be ensured that avatars are inclusive with diverse set of skin and physical features, to achieve this, companies are working with human and civil rights groups for avatar design.
2. **Presence:** Meta CEO described the metaverse as an "embodied Internet" that, unlike the Internet of today, gives one a "feeling of presence." Realistic presence is the key to feeling connected in the metaverse. The research teams at these technology companies are working to improve the environmental understanding, content placement and persistence, voice, and hand interactions to better this sense of presence. Presence platform is a broad range of machine perception and AI capabilities that empower developers to build mixed reality experiences on VR headsets. This would also apply to Mixed reality examples such as doing a workout in your living room.
3. **Home space:** Home space is the default environment in metaverse when the user puts on their VR headset. Users would be able to invite others to join the home space for hangouts and virtual parties as their virtual avatars.