Inside the metaverse: The Internet's next frontier
窺探元宇宙 —— 新網絡世界的里程碑

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The metaverse – as described in the 1992 science-fiction novel "Snow Crash" - is a virtual world that runs parallel with our reality, where people use digital avatars of themselves to interact with one another.

Apart from being a wondrous twin digital reality of our physical world, the metaverse itself is an evolution of the Internet, its next frontier. Part of the magic lies in its ability to make better use of digital intelligence and uncover new insights in an unprecedented way. Leo Liu, General Manager for Hong Kong, Macau region, and Philippines, Alibaba Cloud Intelligence expressed,"We can leverage the potential of the metaverse to help solve real-world problems, paving the way for a greener, more inclusive and technically advanced world."

元宇宙（Metaverse）——一個曾於 1992 年的科幻小説《雪崩》中被描繪的世界，是一個與現實世界平行存在的虛擬空間。在這個世界中，人與人之間的互動都是以數碼人像的方式進行。

元宇宙不單是現實世界的數碼映像，它甚至代表了網絡的進化，是網絡世界邁向下一個時代的里程碑。元宇宙的神奇之處在於它能善用數碼智能（digital intelligence），以前所未有的方式發掘新的洞察。阿里雲智能港澳地區及菲律賓總經理劉彬星認為：「利用元宇宙的潛力可解決現實世界的問題，亦為我們建構一個更環保、更多元化、科技更先進的世界創造了條件。」

Mr. Leo Liu, General Manager for Hong Kong, Macau region, and Philippines, Alibaba Cloud Intelligence
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Transforming city planning and the manufacturing industry

為城市規劃及製造業帶來變革

As cities look to the future, they will need to consider how new technologies like the metaverse fit in and how they are best used to their full potential. As the Industry 4.0 era has demonstrated, with Cloud and IoT technology dominating our everyday lives, the metaverse could provide the perfect playground to simulate what an ideal city looks like and for example, test future buildings before we make any substantial upfront investments.

在構建一個城市的未來發展時，如何將包括元宇宙在內的創新科技融入規劃之中，以充分發揮其潛力，都是值得思考的。就像工業 4.0 所展示的，隨著雲端及物聯網技術在生活中無處不見，元宇宙可以提供一個完美的平台以模擬城市的理想模樣，例如在投放資金前先對未來建造的大樓進行測試。

Real-time, intelligence-driven simulation that underlies the development of a digital twin city can support sustainable design in the real world. For instance, architects can visualise the construction of a building in the virtual world before it commences construction in order to reduce its environmental impact. In doing so they can determine the perfect window-to-wall ratio that maximises natural lighting, or they can anticipate the durability of materials, as well as plan new ways to create more green spaces that preserve the natural environment.

A similar analysis can be applied to smart manufacturing in the industrial metaverse. Building a virtual environment that mirrors real production facilities through AR/VR and holographic technologies is no longer unimaginable. By leveraging connected sensors or Internet of Things (IoT) devices in factories, manufacturers can simulate real production settings in the metaverse. Factory workers can practice operational controls virtually and trace faults against different production settings without having to do any expensive trial runs. Automotive brands can build 3D virtual spaces and use the digital twin to better design and refine their manufacturing processes in a cost-effective way before investing in the production of vehicles.

During COVID-19, overseas workers were trained remotely to familiarise themselves with operations before handling actual machines. This enabled the workers to hit the ground running once travel restrictions lifted.

The intelligence gathered in the metaverse can be transferred back to the "real world" to improve AI algorithms, support intelligent transformation and the upgrading of factories, workshops, and production lines without wasting any physical time or resources.

在發展數碼城市時使用實時、智能驅動的類比分析,能夠幫助現實中的城市使用符合可持續發展理念的設計。舉例說,建築師可以在真正開始建造前運用元宇宙還原該座大樓的影像,從而在興建時減低對環境的影響。透過使用這種技術,建築師能得出最精準的窗牆面積比,以充分利用自然採光。此外,建築師亦能預估物料的耐用程度,並設計新的方法以打造更多綠色空間,以保護自然環境。

類似的分析同樣可以應用於工業元宇宙中的智慧製造。使用 AR(擴增實境)、VR(虛擬實境)及全像攝影技術打造一個可映射真實工廠的虛擬環境已不再只是幻想。透過運用工廠中已被連接的感應器及物聯網裝置,製造商可以在元宇宙模擬真實的製造環境。無需昂貴的技術測試,就可讓工廠員工對機器進行虛擬操作練習,還能在不同的製造設定下追蹤操作失誤的來源。汽車品牌也能建立一個 3D 虛擬空間,在正式投資之前以高成本效益的方式,在虛擬空間中使用產品的數碼版本,以試驗更好的設計及完善他們的製造程序。

在疫情期間,一些海外員工接受了遙距訓練,這令他們能在實際操作機器之前已熟悉有關運作。當政府的出行限制解除後,經過培訓的工人們便立刻可以開始工作。

另外,在元宇宙中收集的具有價值的資訊可以重新傳遞到現實世界,以優化人工智能算法、支持數碼智能發展、以及推進工廠、工作坊,以及生產綫的轉型升級,從而避免浪費時間及資源。

Engaging with Gen-Z customers

In retail, using cloud computing, AI and AR/VR technologies to create 3D virtual spaces and digital ambassadors, has enabled retail brands to attract consumers and stay on top of shopping trends. Using cloud-based XR (AR, VR, or Mixed Reality) solutions to build a "metaverse" of retail stores, is considered essential for brands these days looking to engage with Gen-Z customers. The young and tech-savvy generations have different expectations when it comes to an online experience and gearing up to successfully meet their needs can only be accomplished by adopting the latest in retail technology.

From the consumers' perspective, the unparalleled experiences they are having in the metaverse allows them to access their favourite destinations and embrace immersive feelings like never before. This is especially relevant when travelling is not an option, whether it be for the cost, time, or travel restrictions.

與 Z 世代顧客的互動

於零售業而言，使用雲端運算、人工智能、AR 及 VR 創建 3D 虛擬空間及數碼大使，能助零售商成功吸引顧客並緊貼銷售業的最新趨勢。運用雲端 XR（延展實境）（AR、VR、MR（混合實境））方案以建立元宇宙中的零售商店，對於希望吸引 Z 世代顧客的商戶來説已成為了不可或缺的策略。年輕且善於運用科技的 Z 時代對於網上購物體驗有著更高的期望，商家唯有做足準備，採用最新的零售科技，才能滿足到這些年輕顧客的需求。

元宇宙為顧客帶來了前所未有的體驗，令他們隨心選擇自己心儀的目的地並享受沉浸式體驗。尤其因金錢、時間或出行限制而導致人們無法旅行時，這更能切合顧客需求。

A sustainable future for the two worlds

Tremendous technological advancements are necessary to power the different layers that underline the development of the metaverse. The first layer requires robust AI, cloud and IoT technologies in order to construct a geometric model of the physical environment so it can be displayed on various devices to create an immersive environment. For example, GanosBase, a cloud-native database engine that analyses and translates 3D and 4D data to build digital twins mirroring the physical world, can quickly analyse tens of millions of units of massive geometric spatial data, and code the real-time display of the calculation results onto an interactive 3D map.

Other technologies, like remote rendering, which streams visual inputs to the devices in real-time, and data analytics, are key to constructing the virtual world that closely matches the physical.

To break the boundaries of both worlds, AR and VR technologies are needed to build a high-precision 3D map of the physical world while providing tailored experiences like virtual customer service and navigation, amongst others.

While the metaverse is an exciting development, it will also put considerable demand on energy use and production at a time when sustainability should be the key focus. To address these challenges, organisations need to subscribe to green data centres that are designed, built, and operated to create as little environmental impact as possible. These centres often incorporate core green technologies such as liquid cooling, as well as leveraging powerful algorithms to reduce energy consumption and increase computing power to save electricity, automate monitoring and maintenance among other energy-intensive tasks.

While the metaverse has the potential to become an exciting digital world, we cannot neglect the physical realm we are in. Our growing dependency on technology and energy should not only be considered for how it powers the metaverse, but in how we live our daily lives. Whether virtual or physical, the overarching goal to live in a sustainable, inclusive, and responsible world remains.

兩個不同的世界，同一個可持續的未來

元宇宙由幾個層面共同構建，大量的科技突破對支持元宇宙的發展至為關鍵。其第一層面的發展需要強大的人工智能、雲端系統和物聯網技術，以建立一個實體環境的幾何模型，藉此在不同的裝置上展示沉浸式的環境。舉例說，GanosBase 是一個雲原生的數據庫引擎，它透過分析及演繹 3D 及 4D 數據建構一個與現實平行的數碼世界，從而能極速分析數以千萬計的幾何空間數據，並且把實時的計算結果在 3D 交互地圖上翻譯成代碼。

此外，將視覺畫面實時輸入遠端裝置的遠端渲染，以及數據分析等技術，都是建構與現實對應的虛擬世界的關鍵要素。

要打破兩個世界的邊界，則需要 AR 及 VR 技術建構一個高度精準的 3D 現實世界地圖，同時為使用者提供度身定造的體驗，如網上客戶服務及導航等。

元宇宙的發展雖令人期待，但與此同時這一過程將會消耗大量的能源，其可持續性應更加受到大眾的關注。為應對各種挑戰，相關機構應更加支持綠色數據中心，因為綠色數據中心的設計、建立及運行都旨在盡可能減低對環境的影響。這些數據中心通常採用綠色核心科技如液體冷卻技術，並運用強大的算法以減少能源消耗並提升算力，可在運行高能耗任務時節省電力，令監察和保養工作自動化。

儘管元宇宙具有十足的潛力發展成一個令人期待的龐大數碼世界，但我們也不應忽視我們身處的現實世界。我們對科技及能源與日俱增的依賴，不單是為了推動元宇宙，更是現實世界的問題。無論是在虛擬或現實世界，我們首要的目的都是打造一個可持續、共融且為未來負責的世界。