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VOL. 35 | ISSUE 7 | July 2022

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EXPLORE



Unveiling the Metaverse Architecture layer by later

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Printed and published by Pradeep Gupta on behalf of CyberMedia (India) Ltd, printed at printed at M/s Archana Printers, D-127, Okhla Industrial Area, Phase-1, New Delhi, published from D-74, Panchsheel Enclave, New Delhi-110017. Editor: Sunil Rajguru. Distributed in India by IBH Books & Magazines Dist. Pvt. Ltd, Mumbai. All rights reserved. No part of this publication may be reproduced by any means without prior permission.

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O2 Cure Car Air Purifier



Sunil Rajguru

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Many jobs have become remote

The complete collapse of Uber-Ola

During the pandemic many industries flourished, some survived while others shut down. It was a wide disparity of fortunes. One Indian service which is in the doldrums is the Mobility as a Service one or specifically Uber and Ola. Taxi drivers of this service faced a torrid time with the crash in demand. Now there are less such vehicles on the road as many could simply not sustain themselves and had to sell off or forfeit their vehicles. Some went to their hometowns and appeared to have quit the industry for good.

While air travel has returned with a vengeance, trains faced no such issues being owned by the government. Bus owners also had deeper pockets than the Uber-Ola drivers. That means we are left with a shortage of both vehicles and drivers.

Hailing a cab now is a terrible experience. Surge prices are the norm, but you still may not get one at thrice the price. If you finally get assigned one, it may be too far away or get cancelled at the last moment. If you luckily come face to face with your driver, he may ask you to cancel and pay the entire amount in cash to go to your destination. You are left holding his mobile to key in your address on Google Maps. There's no safety and redressal that Uber-Ola will offer you if anything should go wrong.

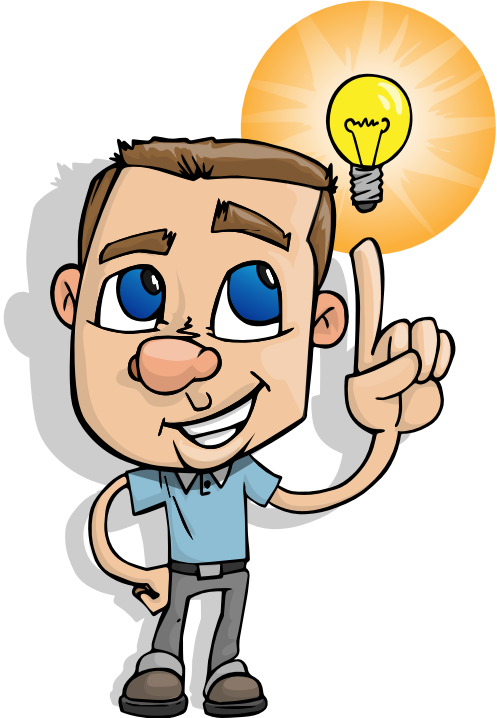
There is no solution in sight. Many jobs have become permanently remote and the migration to Tier 1/2 towns is real. Fewer drivers will now look at Uber-Ola for a long-term career. In the heydays drivers got incentives and low commissions along with job stability. Now they have none of these things.

These companies overall seem to be in a bad shape too. Uber globally is not doing that great and has more controversies than successes. The senior leadership team of Ola has been shaken and their electric scooters, which only some time ago seemed to be the next big thing, have received very bad press. This is a shame indeed for the two rideshares were extremely convenient and they had tapped a huge market.

While the West is pushing driverless cars and public transport, all that is still lacking in India. Will these realities boost remote work and push the collaboration industry even further in India? Will we see the rise of Tier 1/2 cities as industrial powerhouses?

While many sectors have settled down after a turbulent 2 years, the likes of Uber-Ola are still in the air. One doesn't really know where they will be say in another 2 years.

Sunil Rajguru



Ashok Pandey

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What are the best laptops under ₹35000 in 2022?

■ **Shubh Modha**



I would recommend you to check out the Lenovo IdeaPad Slim 3. It's powered by a 10th Gen Intel Core i3 processor along with 8 GB RAM, 512 GB SSD and Intel UHD Graphics. It comes with Windows 10 operating system. The 15.6-inch HD screen laptop costs INR 34,990. Powered by a 45 Whr battery the laptop can last for around 8 hours.

I found my 14-year-old son in his room watching something inappropriate on his laptop, what should I do?

■ **Naveen Kumar**



Windows provide you parental control features to restrict laptop usage.

Here are the steps you can follow on Windows 11.

Press



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Windows key + I to launch the Settings app, click on the Accounts tab then go to Family & other users.

Click on Add account next to 'Add a family member.'

Click on 'Create one for a child' and follow the on-screen instructions to create a new account. Once done, the child account will be linked with your Microsoft account. From there, you're all set to manage it. You can limit screen time and use a content filter to restrict content as per your wish, etc.

What are the best laptops for writing?

■ **Ubaid Ahmad**



As a writer, you would be running various apps constantly on the laptop, browsers for research, word for content creation and other apps. You should go for a laptop with 8 GB RAM along with a good keyboard that is easy to type on. In terms of processor, you can rely on the newest Intel Core i5 processor. This combination can help you run most of your tasks. The processor can handle the load and the RAM provides enough memory for you to work on multiple tabs and things at the same time without showing a lag. On the storage side, you can go for 512 GB SSD or higher so it loads faster as well as you have an ample amount of storage space.

Is an iPad enough or I should go for a laptop?

■ **Akanksha Singh**



It's not an apples-to-apples comparison. An iPad is a tablet, and even though it's a very powerful device, it's primarily meant for content creation. It will let you run some applications like Microsoft Excel, Affinity

Photo, etc., but you can't do serious content creation with it. Moreover, you won't be able to run more graphics-intensive applications on it. For content creation, and to run more powerful graphics-intensive applications, you need a laptop. You have not mentioned what course have you taken up in college because the right laptop configuration will depend upon that. If you learning to code for instance, then it's better to buy a laptop with an Intel i5 or higher CPU, 8 GB RAM and an SSD.

What is the best laptop for a freelancer?

■ **Mukul Sharma**



You have not specified your exact freelancing work, as a freelancer is a very broad term. You could work as an author, creative professional, marketing professional, or something else. The laptop configurations would vary according to the profession. I'll give a few laptop options for some professionals to give you an idea.

If you are a Digital Marketer, then you will need a laptop that has decent connectivity options along with good battery life and plenty of storage, so you can check out a laptop powered with the latest 12th Gen Intel Core i5 processor, 8 GB RAM and 512 GB SSD to store all your data. If you are a creative freelancer who works with animations and graphics, then going with a mobile workstation might be a better option. Go for Dell or HP mobile workstation equipped with the Intel Core i5 11th Gen processor along with 16 GB RAM, and a minimum 512 GB SSD.

What features should be kept in mind while buying a laptop?

■ **Balram Mahato**



When you buy a laptop first thing you need to understand is your purpose – personal or professional. If it's personal, then you can look at a laptop with moderate hardware configuration. Go for a lightweight laptop powered by the latest-gen Intel Core i3 or higher processor depending on your computing needs. The minimum RAM should be 8 GB RAM and 512 GB SSD for better overall performance. Try to

choose an FHD (1920 x 1080), anti-glare screen so it won't hurt your eyes when you use the PC for long hours.

If you are looking for a professional laptop, then a solid build, lightweight, powerful and secure laptop should be your choice. You should choose a business book as many features differentiate them from consumer ones. Their overall purpose is to ensure a secure device that enhances a working professional's overall productivity. These business laptops come with OS-level security in the device so that security attacks don't end up destroying your device's firmware. Business laptops come with BIOS protection to protect your PC from many modern-day malware programs. If you are a power business user, then a mobile workstation-class laptop would be a better fit for you.

Which is the best laptop for animation?

■ **Aditya Kant**



For animation, you need a powerful machine with a good processor, at least 16 GB of RAM and discrete graphics support. It will be better to choose a mobile workstation for instance Dell Precision or HP ZBook Mobile Workstation. You can choose a configuration like the latest Generation Intel Core i7 processor, 16 GB RAM and 1 TB SSD, along with dedicated 4 GB graphics. This combination would provide the required computing power to run animation programmes.

What is the best laptop for music production?

■ **Bhola Kumar**



For music production, you need a laptop with the latest Intel Core i7 CPU, however, i5 would also work if you have a budget constraint. Look for 16 GB memory and 1 TB storage that can store all of your files as some music files can go up to multiple Gigabytes. Connectivity options are also important in a laptop for music production as you might want to plug in multiple devices to the laptop at the same time. A better choice would be a workstation, with a dedicated GPU of 2 GB or higher would be better.

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Unveiling the Metaverse architecture layer by layer

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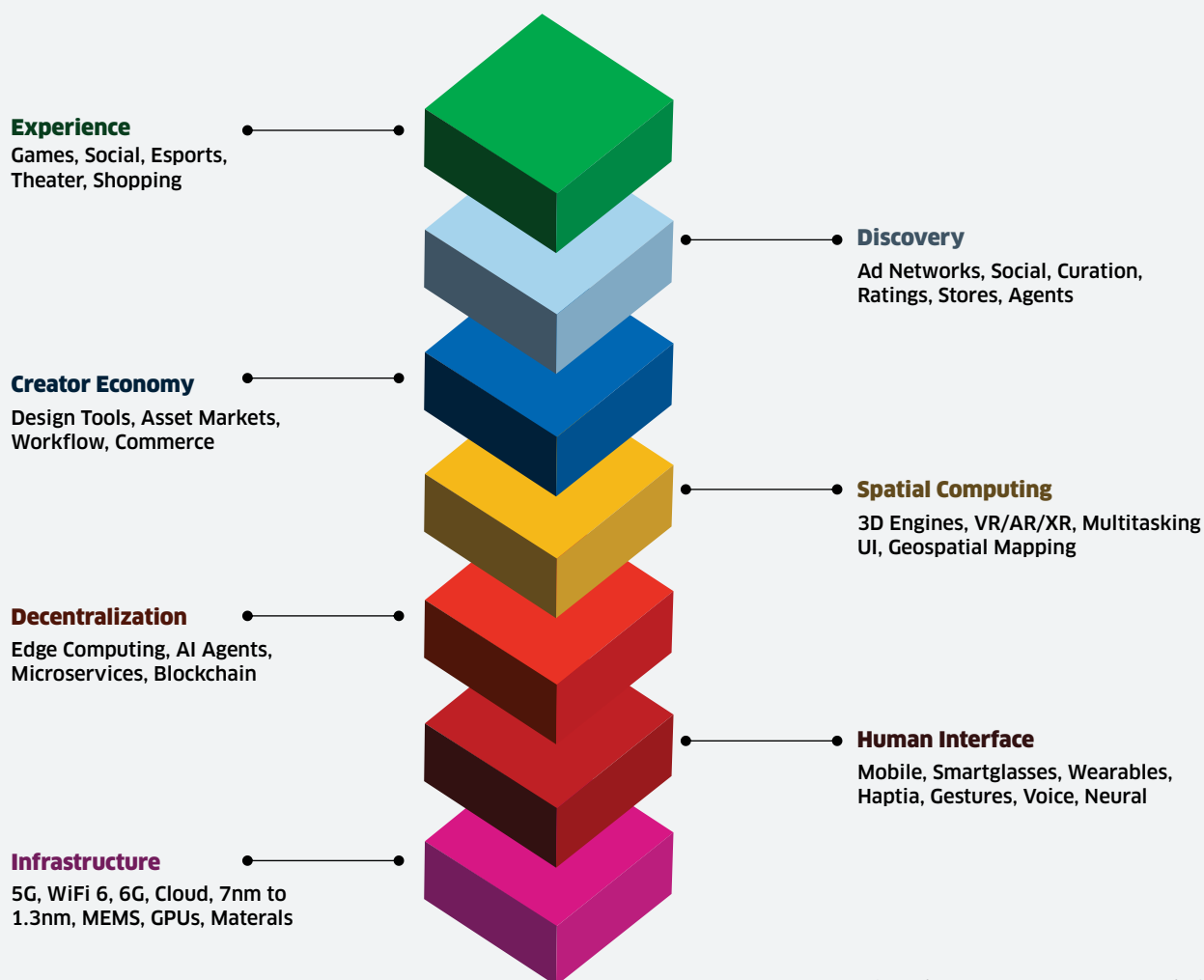


The Metaverse platforms are divided into two core types, centralized and decentralized. Before you decide which platform is a perfect fit for your business, there are many things to consider. Here's a complete break down of the metaverse architecture along with a list of pros and cons

The virtual world might remind you of some sci-fi movies like Matrix, where imagination used to take shape. The metaverse lets us extend our real lives with extraordinary experiences. It's like a second life that can be designed as per your wishes. You can build your avatar in a 3D environment and explore them across various setups and platforms. Companies like Meta (formerly Facebook), Microsoft, and other enthusiasts, are creating a whole new digital world for everyone to live online.

The technological progress from Web 2.0 to Web 3.0 also paves the way to develop the imagined world of your dreams into the metaverse. The Web 3.0 elements like decentralization and technologies such as Byzantine Fault Tolerance (BFT), blockchain, cryptocurrencies and computation, etc. have given birth to a new internet era. The virtual universe where VR (Virtual Reality), AR (Augmented Reality), MR (Mixed Reality), Gaming, Social interaction and commerce come together to create a unique experience that bridges the gap between the real and digital worlds. As many metaverse projects are being introduced and many more are yet to come, it is significant to understand the inherent layers of the metaverse architecture.

The Seven Layers of the Metaverse



Source: *Measuring the Metaverse*, Jon Radoff



▼ Infrastructure

This layer consists of technological infrastructure needed to build a fully functional metaverse and keep everything running smoothly. The infrastructure layer includes power grid, cloud computing services, Wi-Fi capabilities, 5G and 6G networks and advanced GPU technology. This layer is a kind of foundation for the metaverse that runs on powerful computers, network equipment, integrated circuits, advanced display systems, communication components, mixed reality equipment and sophisticated high-resolution cameras, etc.

▼ Human Interface

This layer is all about the hardware and devices that enable users to experience the life-like world of the metaverse. Devices like VR headsets, smart glasses, and haptic technology will enable users to transport themselves to the digital world of metaverse. They would be able to upload their super-realistic 3D avatar into a virtual world. These hardware will play an essential role in transporting people to these different worlds and making them as realistic as possible.





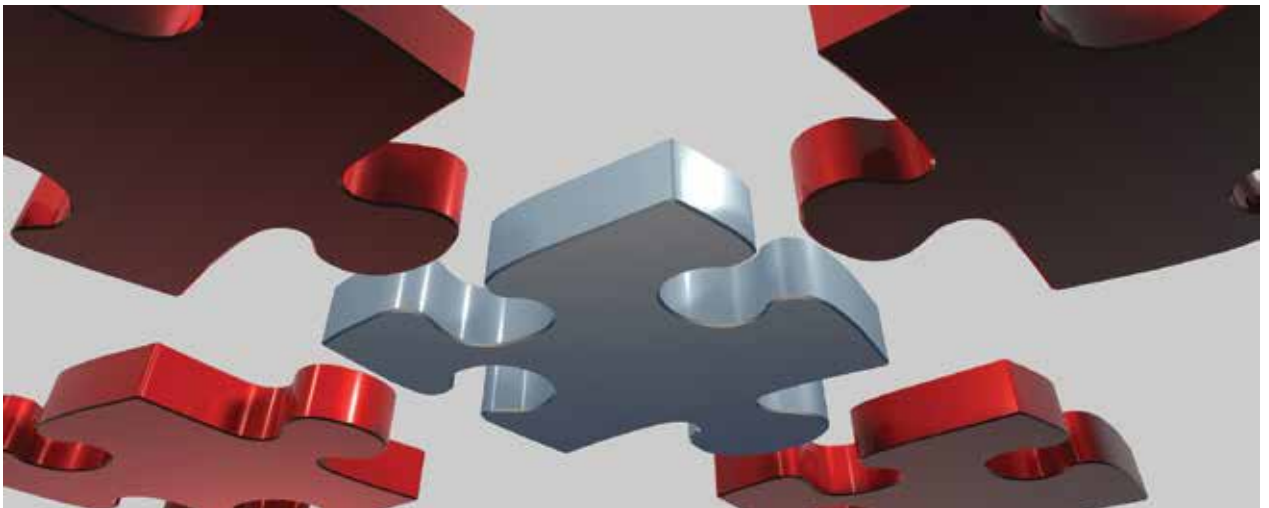
▼ Decentralization

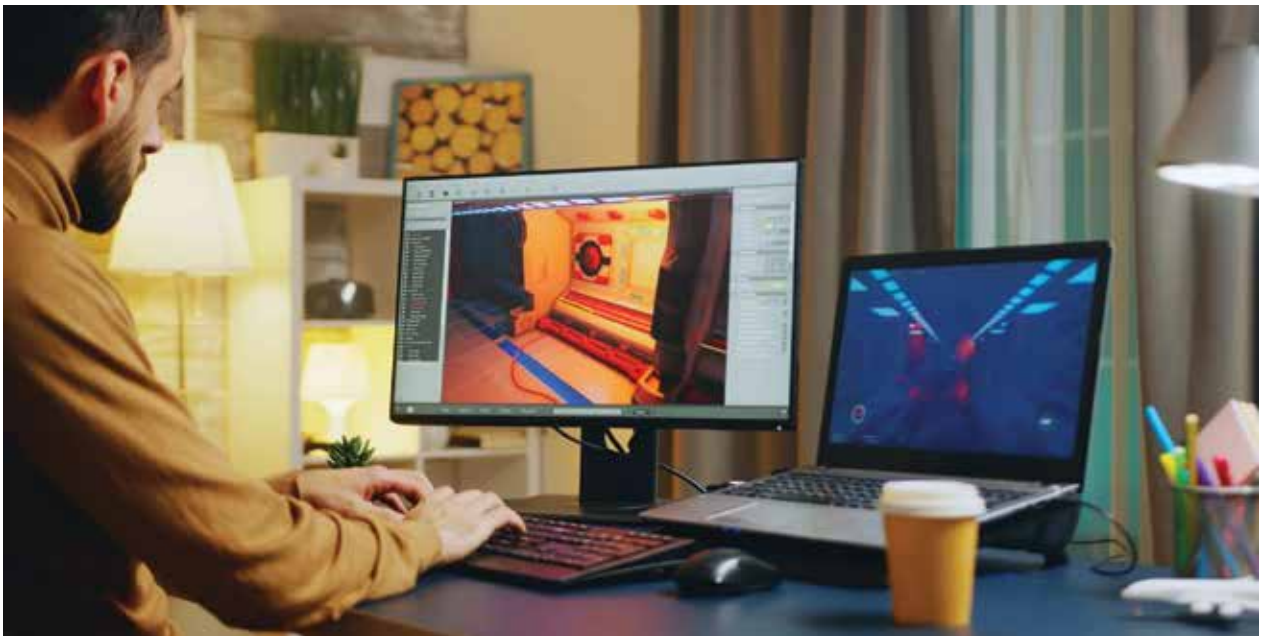
What if any central authority controls the entire metaverse data? Well, then it would be difficult for users to validate who is accessing what data and under what conditions. Technologies like Blockchain, smart contracts, open-source code, etc. help to decentralize everything, so that it's not get controlled by one entity. Blockchain helps to overcome privacy and data security concerns. Decentralized finance (DeFi) is a process that makes financial goods accessible over a decentralized blockchain network utilizing DeFi wallets like Metamask and True Wallet.

▼ Spatial Computing

This layer merges AR and VR, and enables creators to develop 3D and super realistic worlds. AR, VR, and XR all fit into this layer. Essentially, the spatial computing layer enables users to interact with both the real and virtual world simultaneously in real-time. To get the desired results in this layer, creators require specialized software and hardware. There are various aspects of the software layer in spatial computing –

- 3D engines (Unity and Unreal Engine)
- Geospatial mapping and interpreting the inside and outside world (Cesium, Descartes Labs, and Niantic Planet-Scale AR)
- Data integration (Internet of Things) along with biometrics
- Voice and gesture recognition
- Human biometrics for identification purposes





▼ Creator Economy

But, without content what would you explore in the metaverse? Hence, content creators will be crucial in shaping the metaverse experience. Thanks to the web app frameworks, now anyone can develop web apps without knowing how to code. Independent creators will be able to create digital content such as e-books, photos, videos, webinars, and other digital items.

▼ Discovery

The Discovery layer can be described as the Push and Pull layer, where users seek or get information. Push means outbound methods of pushing messages out to the users, and it doesn't matter whether they ask for it or not. Pull, means the inbound method of seeking information.



Inbound: Community-driven content, Real-time presence, Search engines, App stores, and Earned media

Outbound: Display advertising, Social media, emails, and Notifications

▼ Experience

If you think it's another virtual space in 3D, then it's not true. Metaverse is more than a digital world, offering an ultimate dematerialized version of physical space, objects and distance that includes 2D and 3D graphics. And to get the immersive experience, you would need devices like VR headsets. The look and feel can be the same as the physical world or you can digitize the space as per your taste.

Experience is what matters to every user, and metaverse is going to give you that in a digital format which would feel like the real thing. Have you ever missed a live concert and regretted it later? Now, what if you can have the same experience while sitting at the comfort of your home? Metaverse gets you in the crowd without letting others push you or spilling drinks all over you. Depending on the users' interaction and requirements, it might be possible for you to shop for your favorite outfit after wearing it in the digital environment. The possibilities are limitless, metaverse is going to change the way you play games, shop, bank, etc. and more.

A large aspect of this layer will be the community-created events and assets. The ability to do this easily and with little funds matters the most in this layer. This includes the most commonly known projects and companies and it is this layer that receives the most attention from investors. This is how users interact with a digital environment through applications, games, and shopping experiences such as marketplaces, NFTs, e-sports, and other events.



▼ Here are the top 7 Metaverse platforms

Fueled by the giants like Meta, Microsoft, Epic Games, etc. the metaverse market is expected to reach USD 829 billion by 2028. The graphically rich virtual world still doesn't exist, but users will get an immersive experience. Though no one can say when it will replace social media networks, the metaverse will certainly unlock a set of new social and financial benefits.

Here is the list of the top 7 metaverse platforms that are likely to replace social media in the future.

▼ Decentraland

The 3D virtual world browser-based platform is based on blockchain that records cryptocurrency transactions across a network of computers. Users can buy virtual lands on the platform as NFTs via the MANA cryptocurrency, which uses the Ethereum blockchain. The platform can be used for various things like playing a game, hosting conferences and trading virtual products in marketplaces.



▼ Sandbox

Sandbox is a blockchain-based game and metaverse world where you can buy and sell digital plots. The company has developed its own Ethereum-based token called SAND. It's a secure and stable token to do transactions. Users can play games, build properties, and monetize their virtual experience.



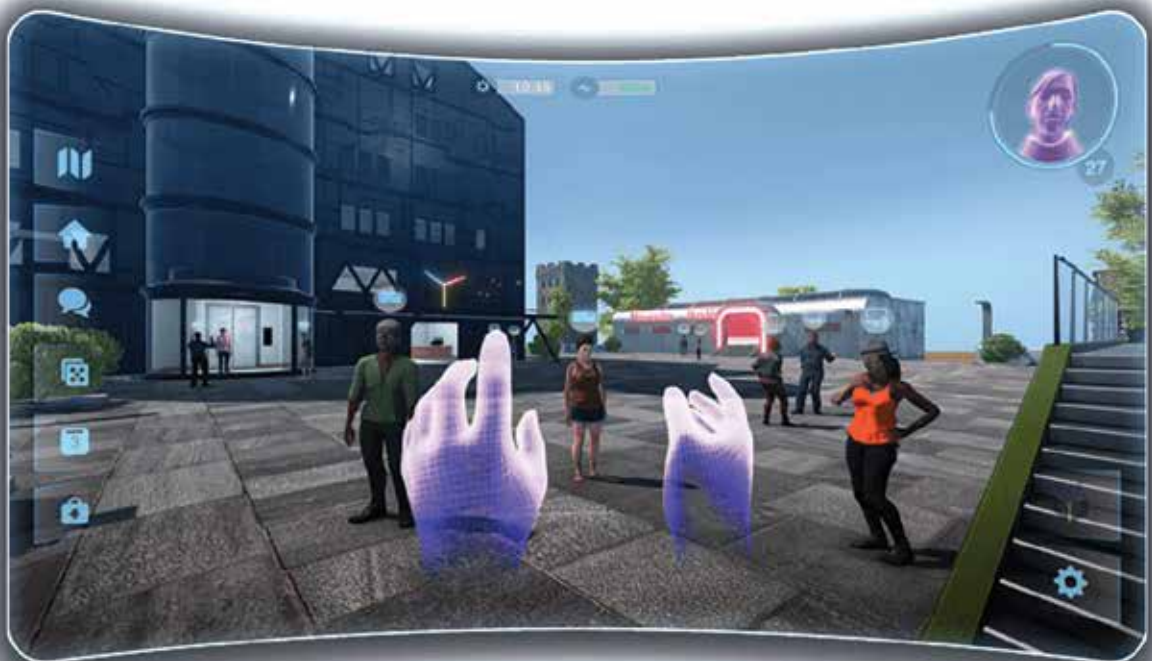
▼ Spatial.io

The platform lets you create immersive events, art galleries, community hangouts, NFT exhibits, creative collaboration, and more. Enjoy immersive 3D environments and create your own space filled with your own custom objects. It also enables users to start in Web 3.0 for free.



▼ SomniumSpace

An Open, Social, VR world with its own economy and its own currency. At Somnium you would get its own set of Marketplace, Games, and more. Additionally, it has a VR world which is fully interconnected and seamless and can be accessed from any device: PC & VR clients for the user's Desktop or an immersive VR experience on mobile devices.



▼ Room

It is an all-in-one platform for content creators and event organizers. With Room you can create, manage and share impressive 3D, AR and VR experiences. Here you would get specialized enterprise metaverse solutions, virtual showrooms, 3D product presentations and virtual events.



▼ Rove.to

Rove metaverse platform opens a world of opportunities for your NFTs: own 3D spaces, display NFTs, find your tribes and hang out with like-minded people. You can build your community on your own metaverse. It is the first truly community-owned metaverse platform where 3D space owners decide how their metaverse is run and how their digital economy works.



▼ HyperVerse

A complete sci-fi platform of virtual worlds. There are multiple planets, and many planets comprise the HyperVerse. It is actually a digital universe with millions of worlds. This universe is not owned by a single entity. Every user can create their tokens, explore the world and make new friends.



▼ Weigh the pros and cons

Every technology has its own pros and cons, and metaverse isn't an exception. Many see the potential to create a whole new world and experience, while others believe it can be more dangerous than good.

Pros of Metaverse



- ▼ **Connecting the world without any geographical barrier** – Virtually we all are being connected over different platforms, metaverse will take that to the next level. There will be no geographical boundaries, you can have an immersive experience in the virtual world irrespective of where you live. It's a world without boundaries where anyone can meet anybody. On top of that, you can make new friends from the comfort of your home.
- ▼ **Immersive collaboration experiences** – The pandemic pushed every individual to shift online. Most people have learnt to operate some tools extensively for online communication. Now, even when

things have started going back to normal, industries are still using those online tools for communication, be it education, medical, e-commerce, or any other. Metaverse offers an immersive experience and is one step ahead of these virtual tools. It can help to create any type of environment – college, office, or any other virtually designed space.

- ▼ **More than social networks** – During the lockdown, we had only one option to interact with our friends and family – social media. We all were dependent on social networks, despite it not being the most interactive experience. Now with metaverse, things will change, users would be able to experience it like they interact in person with their friends and loved ones. Whether it is office meetings, or parties and concerts, they all can be managed in the metaverse.
- ▼ **Create new business opportunities** – Like social media, the metaverse is also going to create numerous new business opportunities. We will soon witness a new form of marketing and advertising, as metaverse isn't restricted to a tiny mobile screen only. It is accessible through different VR tools and devices as well. Not only that, in the metaverse, the shopping experience would be like virtualized storefronts with highly interactive engagement, curated shows and customer service, meaning before buying, you can touch and feel the product using the haptic technology (experience of touch through vibration, forces, and motion).

Cons of Metaverse



- ▼ **Cybercrime** – Metaverse works on the concept of decentralization, which means the government would have less power to fight against cybercrime. It is a serious concern since the internet has been introduced. Governments are spending millions of dollars to secure you from these crimes and attacks. But I am afraid metaverse will open more gates to the cybercriminals to perform all sorts of illegal activities, such as fraud, money laundering, services trafficking, illegal goods, child exploitation, and cyberattacks etc.
- ▼ **Privacy and security issues** – From the beginning of the Internet era, privacy has always been a concern and people are more concerned with the way their data is being collected and sold to advertisers, and others. In the metaverse, we would use technology like AR, VR, XR, etc. for a truly immersive experience, all of these come with major privacy challenges. These technologies will be able to track your eye movements, physical reactions (emotions and physical reactions), etc. which means they can collect enormous amounts of data for marketing or other purposes.
- ▼ **Addiction problems** – The gaming industry seems to be very excited and one of the first movers in the metaverse. And like gaming addiction, users can also fall for the metaverse addiction. If you live in your dream place, you won't be able to leave it for a longer time except for your essential physical needs like eating and sleeping. We have to be more alert with our kids and teenagers, as they are the most at such risk. Metaverse would replicate the real world, making it difficult to differentiate between the real and the virtual lives. It will become the biggest challenge to balance real and virtual life.
- ▼ **Virtual bullying** – Cyberbullying isn't new after all and metaverse won't be an exception. Strangers tend to be cruel and one can face malicious behaviors. Despite several laws and campaigns to prevent cyberbullying, no one can claim to stop it completely. In the virtual world, where your identity will be public, the bad guys can gain more power over you. They would get more opportunities to attack others. ■

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What the Metaverse is and what it is not

Rajashree Maheshwary✉ pcquest@cybermedia.co.in

One needs to see beyond the cartoonish aesthetic that we come across today in the name of a metaverse experience. The Metaverse won't just be an arbitrary caricaturist game-world built by developers. It will be digital replicas of very real spaces, and digital twins of actual objects. It is about integrating the virtual world into the physical world

The year was 1982, the place was Daman where we were planning to spend the summer vacation. We had spent many there, but this was special for a particular reason. It was the first time we would be laying eyes on a television set. I remember dreaming about what it might be like. My imagination knew no bounds, but when reality struck, I was thoroughly disappointed.

I had fantasized about round-the-clock movies, a plethora of games and endless entertainment. And here we were, this nondescript box sitting in front of us, switched off, as we waited for the 7:30 pm news bulletin followed by a 30-minute program on agricultural updates. It was a thorough disappointment for the pre-teen in me. I returned to my world of books, hoping that one day we would get something more fun and meaningful out of the TV. Eventually that did happen, but it did take a few years.

A decade or two later, I experienced the same excitement of anticipation when I bought my first cell phone (before the turn of the century) - the idea of making a phone call from a moving car or train was mind-boggling. There was a catch though. Every incoming call



RAJASHREE MAHESHWARY, President,
McLaren Strategic Solutions

was priced at Rs 17 - this at a time when gold would fetch you Rs 4,000 for 100 grams. That's 235 minutes of jabbering or 100 grams of gold!

A few years later, not only was making calls much cheaper, but the cell phone had also become ubiquitous. I recently read that

a generation of students don't even know what the word "landline" refers to.

Imagine you were transported to 1947 while India was celebrating its independence. What would you report or cover with your cell phone and bring back to 2022? What would you tell your fellow citizens of the technological leaps we were to make in the coming years? Now remember, even then we did have computers that were built for World War 2 - gigantic, slow machines operated by programmers who would literally stick their hands inside the contraption to make them do the work. The man-machine interface was very physical. Subsequently, engineers developed newer





interfaces using punch cards; these interfaces would later progress to more sophisticated and natural language like interfaces such as the MS-DOS operating system. This was a game changer because now one could interact by typing words - a more natural way of interfacing. But the real breakthrough moment for computers was the creation of the Graphical User Interface (GUI) - this made it possible to interact with computers by “clicking” pictures - it’s what most of us take for granted, and it’s simply the way we all function today. GUI’s are now used in everything from ATM’s to ticketing machines - and they are the primary reason why any ordinary person, even the most technically challenged, can make use of them.

At each phase of our technological advancement through every decade, computers made machines more accessible - becoming easier to navigate, allowing more people to use them. Over the past several decades, every time designers and engineers made computers work more intuitively - every time a layer of machine-like abstraction was removed, computers became more useful, and more valuable to us.

Today, if you pay close attention, the next era of the computing interface is emerging, though in truth it has been in development for a while. And by that I mean concepts like augmented reality, virtual reality, mixed reality, immersive computing, or whatever two-letter acronym you may stumble upon. All of these advancements involve the use of

three-dimensional space - which is a very big deal when it comes to intuitive and more human-like interaction with machines.

A more generic term for this 3D way of interfacing is called “spatial computing”. A word of caution though. 3D based interfaces, or spatial computing should not be confused with the Metaverse, nevertheless it is related, but we’ll come to that.

Typically, spatial “things” have the properties of being able to move around in space - for example a video game like Fortnite is spatial (you move around within

it) whereas a Zoom call is not.

▼ Okay, so we know what the Metaverse is not. Let’s understand what it is.

For starters, very soon few will even call it the “Metaverse”. In the same way that people had once called the internet “the information superhighway” or “cyberspace”. Based on Gartner research, the Metaverse is expected to be:

- A collective virtual shared space, created by the convergence of virtually enhanced physical and digital reality.
- It is persistent, providing enhanced immersive experiences.
- It will be device-independent and will not be owned by a single vendor.
- It will have a virtual economy of itself, enabled by digital currencies and non fungible tokens (NFTs).

The Metaverse is a combination of Spatial Computing and Game Engines designed to create an immersive experience in Virtual Environments with Virtual Economies (NFTs. Social tokens etc., and we’ll come to that soon).

The Metaverse is the internet in its new avatar - spatial (and often 3D) in nature, primarily game-engine-driven and a collection of virtual environments built to provide an immersive experience - a virtual 3D world, if you will, where you would be controlling a virtual avatar with digital property rights.

The Metaverse will also have rules and regulations, however it is early days and firms

like Meta and Microsoft are paving a way for a more standards-driven metaverse. One might wonder what one cannot do with the current internet that one can in the Metaverse? It's more or less like asking what the benefit of digital banking is when you already have web-browser based Internet banking.

The application of the Metaverse will be far beyond the usual gaming and learning use cases. For instance, take a look at Protectwise, now owned by Verizon - they have gamified cybersecurity in a way that monitoring cyberthreats is more natural and can be done by anyone. One doesn't have to sift through logs of data to detect threats.

There are numerous other examples - music concerts and even weddings being held in the metaverse. As the technologies get refined and the standards of interoperability get firmed up, we will see a rapid change in how newer, more human-like experiences will take over the internet.

In a few years, the Metaverse will be a place to do banking, shopping, experience entertainment and much more. If you go by the experts relentlessly tweeting about its impact, the Metaverse will not just be a place

or a virtual environment, but a time when your digital life (avatars, experiences, connections) is worth more than your physical life.

And if this sounds absurd, try posting an unflattering picture on social media. Would you? Why do we care about our Instagram pictures? Our LinkedIn profiles, and the content we post? It's simply because our Digital life or "presence" plays a far greater role in our daily life, and has an impact way beyond what we might even be able to imagine.

One of the key components of the Metaverse are the "Game Engines". These are the construction tools used to build the Metaverse. Game engines may well be one of the most consequential technologies of the decade. A Game Engine is what the software developers use to build games - it enables one to upload 3D objects, apply rules for how those objects can move, add sounds, etc.

The term "video game" is also misleading, since it alludes to something recreational or less serious. As the world becomes more digital, Game Engines are powering the computing interfaces for all sorts of industries.



Another concept that will be central to the idea of the Metaverse is the “Digital Twin” - the concept that physical things (like a car, machine, etc) can use its sensor data to create a software copy of itself inside a computer. This allows us to interact with simulated objects in the same manner as we would interact with computers.

There's much happening in the world of Game Engines, and will warrant dedicated attention. For now, there are two engines to keep an eye on: Unreal and Unity. Unreal is owned by Epic Games, the publisher who owns Fortnite, and Unity is a large publicly traded company. These Game Engines are going to see stratospheric and mind boggling levels of improvement in the coming years.

Let's take the example of the electric Hummer - the first car to have an Unreal-Engine based interface. It takes information from its sensors and visualizes it in 3D on the dashboard - a classic example of spatial computing in the real world.

Taking this a step further is Hong Kong International Airport's Terminal 1 which uses a digital twin in the Unity game engine. It gives facilities managers a real-time view of passenger movement and reveals equipment that might need repairs.

The key takeaway is that graphics will stop looking like graphics, and we'll see photorealistic virtual environments that appear as real life. One needs to see beyond the cartoonish aesthetic that we come across today in the name of a metaverse experience.

The Metaverse won't just be an arbitrary caricaturist game-world built by developers. It will also be digital replicas of very real spaces, possibly even the entire planet, and digital twins of actual objects like your car or house. It is about integrating the virtual world into the physical world. Essentially, you could be working in the Metaverse controlling equipment, supply chains or selling art.

The potential is just so vast that it's about remodeling our thinking for what could be possible. it's really all about our imagination and how far we can stretch it - perhaps akin to living in the 1950s and envisioning the potential impact of the internet.

The vision of the Metaverse is that

all of these experiences will become an interconnected network of virtual environments, in a manner that will alter and elevate the way we experience the internet.

▼ It's time for enterprises to start planning for their existence in the Metaverse.

JP Morgan, in the report titled - Opportunities in the Metaverse, revealed that the Metaverse will most likely infiltrate every sector in some way or another in the coming years, with the market opportunity estimated at over \$1 trillion in yearly revenues.

It also became one of the first banks to have a lounge in the metaverse. While it took the internet some two decades to proliferate into banking, the mobile phone took a matter of few years.

As we go beyond 2D and into 3D, we can design an expansive universe with the ability to immerse customers. Banks and other businesses should consider newer ways of operating where experiences will drive growth and lead to new business models.

As the metaverse technologies mature, traditional businesses like banking will be moving to newer business models. As extraordinary as it may seem, enterprises will need to consider possibilities that will transform everything from the very basics to the future of business.

▼ Is it too early or too late to consider the impact?

I would say it's too early to make a significant investment for businesses. However, the time is right to consider the potential uses - there is a case for being prepared, creating readiness in terms of the anticipation of employee skills and customer expectations.

Interestingly, the futurist Alvin Toffler's comments are more relevant now than when he was first quoted in the 1970's - “the illiterate of the future will not be the person who cannot read. It will be the person who cannot learn”.

Let's then gear up and learn what the metaverse is set to unleash upon us! ■

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XR needs to become mainstream to bring the Metaverse to the masses

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With the use of AR, VR, & XR technologies, the Metaverse can create virtual experiences that feel life-like. We have the hardware to render realistic virtual environments and avatars in 3D already and XR headsets are likely to become the entry points of choice for users logging into the Metaverse

The metaverse offers a future full of potential. It is predicted to grow as a digital platform for personal and business interactions. Businesses and brands across industries have started rushing into the meta world in order to establish themselves as forerunners of the digital future. Qualcomm Technologies, too, is well positioned to support the development of technologies for the Metaverse – technologies for creating experiences that span both the physical and the digital worlds. To know how it will impact the future of businesses, we spoke to **Brian Vogelsang, Senior Director, Product Management, Qualcomm Technologies**. He also explains what it takes to bring the Metaverse to the masses.

▼ Making the Metaverse mainstream

The Metaverse can be best understood as the next generation of the internet, and large parts of it will be based on Extended Reality (XR). But, XR will need to become mainstream first to bring the Metaverse to the masses. This will require breakthrough technology advancements and industry-leading talent. Qualcomm's XR labs are working in this space to develop breakthrough experiences that will accelerate progress towards the Metaverse.

It has been predicted that VR and AR headsets will surpass global gaming console shipments as early as 2024. Just like the introduction of PCs and smartphones heralded new eras for mankind, so will the widespread adoption of XR. XR headsets will revolutionize digital experiences and become the entry points of choice for consumers logging into the Metaverse.

The Metaverse will be driven by different technologies, cloud infrastructure, software tools, platforms, applications, user-generated content, and hardware. It will also include new experiences in entertainment, gaming, commerce, social interactions, education, and research.

5G and 6G will play a crucial role in enabling and shaping the Metaverse. These technologies, along with Edge Computing, will provide the high bandwidth and low latency that are needed for advanced Metaverse applications.



BRIAN VOGELSANG, Senior Director, Product Management, Qualcomm Technologies

▼ Skilling for the Metaverse

The Metaverse will create new job roles in areas such as Metaverse research, Metaverse planning, Metaverse storytelling, experience designing, environment architecture, distributed ledgers, token economics, and more. The current and future workforce will need to be equipped with the skills needed to perform these roles effectively. These include skills in XR, blockchain, gaming, security, AI, and other such areas. As the Metaverse entails a blend of physical and digital worlds, there will also be demand for skills in 3D art, 3D commerce, digital currency, and digital asset markets. All of this will present a multitude of opportunities for the tech talent in India.

▼ Aligning Snapdragon Spaces with the Metaverse vision

Extended Reality (XR) is one of the most important elements of the Metaverse, and we are committed to furthering advancements in this space with our Snapdragon Spaces XR Developer Platform. Snapdragon Spaces is designed to support companies and developers in pioneering the next generation of spatial computing. It provides APIs, developer kits, sample code, documentation, and the support that developers need to create

advanced, immersive experiences. Developers can create innovative AR applications and immersive digital experiences with the help of our powerful, open-platform tools and robust ecosystem of partners. We provide technology to developers, who, in turn, share feedback that helps us improve our technology further; it is a mutually beneficial cycle.

▼ Metaverse opportunities for businesses across industries

Financial institutions are among the many businesses that are leveraging this technology. Metaverse is predicted to grow as a digital platform for personal and business interactions, including financial transactions. The Metaverse will find applications in the healthcare industry too. It could, for instance, help in training doctors by creating simulations of real-life surgery procedures and the complications that could arise therein. The Metaverse can also be used as a medium of rehabilitation to help patients recuperate better and faster.

The Covid-19 pandemic opened the doors for VR-based entertainment and events. Now, many of the world's biggest media and entertainment companies are looking for ways to engage their fans and audiences with Metaverse experiences and events.

▼ Powering the future of gaming

We are already seeing Metaverse concepts such as 3D avatars and world-building being employed in games such as Sim City, Minecraft and Second Life. The trend toward online, interactive, immersive gaming will continue in the future.

Enthusiasm for multiplayer and social games existed much before the concept of a Metaverse emerged. Now, with the Metaverse on the horizon, gaming companies have an opportunity to create even more immersive gaming experiences. The opportunity is even more pronounced for play-to-earn or Non-Fungible Token (NFT) games, where players will be able to sell or buy assets in a virtual environment. The Metaverse will also make game resources more portable, allowing companies to smoothly oversee the transfer of in-game “weapons” or “avatars” from one virtual gaming environment into another. As

more users join the Metaverse, more gaming companies will focus on monetizing the gaming experiences they offer.

Due to the use of AR and VR technologies, the Metaverse will create virtual experiences that feel life-like. Metaverse game developers will use blockchain technologies and AI to make the gaming experience more immersive. Blockchain has been helping with the development of decentralized Metaverse projects by offering benefits such as digital proof of ownership, transfer of value, digital collectability, and interoperability. The Metaverse will leverage the internet of things (IoT) to collect and use data from the physical world, providing the sensory network to contextualize the virtual realm. It will also use 3D reconstructing, to enable mimicking of real-life body movements on the player's avatar.

▼ Potential data privacy/cyber security risks

As with any new technology or concept, the Metaverse too has raised concerns over privacy and security among experts. The Metaverse will contain sensitive, private, and confidential information relating to individuals and organizations, and users will leave data trails there, just as they do today on the internet. Stringent regulations and laws will need to be created and enforced to ensure privacy and security of user information. Organizations need to invest in holistic security measures and data policies and keep upgrading them to keep pace with the threat landscape. There is also a need to educate the workforce and the general public about security in an increasingly and more intricately connected digital world.

Amidst ongoing debate on the privacy and security risks of the Metaverse, organizations that wish to develop or use the technology should formulate and share best practices on how to handle user data in a manner where users can move freely from one experience to another without having to worry about privacy. Additionally, companies should employ identity services and access management platforms to enable users to choose how their data is handled, and to share information selectively. ■

How UI/UX designs will shape the Metaverse

Alex George

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Just like architects are responsible for building structures, the furnishing of graphical marvels and other environments is virtually done by the UI and UX designers. They are the architects of the metaverse world

The Metaverse is the most recent breakthrough in virtual entertainment and is even integrated with social media. A growing number of companies are putting money into metaverse-based games and non-refundable tokens (NFTs). Forever 21, the famous American fashion retail store, features a shopping game that allows users to explore digital products and collections. Luxury labels such as Gucci and Louis Vuitton have started auctions for digital items on Metaverse. Today, not only gamers but also edtech entrepreneurs and marketing experts utilize this platform to carefully put together brand advertisements and acquire millennial clients. The Metaverse has gone beyond the flat 360 degree scope and used the RPG model in its customer-centric user experience alongside its dynamic user interface (UI) and user experience (UX) designs and augmented reality (AR) and virtual reality (VR) technologies.

Mapping UI and UX in the metaverse

With the advent of VR and AR, the area of UI and UX design is evolving. This dynamic development is gradually infusing innovation within the Metaverse. It has introduced a new perspective on digital engagement and entertainment options for advertisers, as well as strategic technology advancement. The UI and UX concepts in Metaverse are a blessing for global luxury businesses seeking to capture the interest and buying power of the people. With a portfolio of digital products, NFTs, and virtual games, Metaverse consumers have grown more engaged with these companies.

The UX of the virtual world on Metaverse enables marketers to employ AR and AI to build game entities and experiences which consumers would miss in reality. If the platform's UI and UX are used well, it may serve as a progressive doorway to convert millions of passive users into active customers. It requires a deliberate and intentional information architecture that integrates UI and UX with AI and VR to enhance the consumer experience.

Applicability of UI and UX in Metaverse

While designing for Metaverse, UI and UX



ALEX GEORGE, Co-founder & MD, ITLH

designers must strategically comprehend and meet the business and client objectives of the platform. The Metaverse is more than an immersive and engaging platform; it aims to gradually introduce people to blockchain and cryptocurrencies. Brands have begun incorporating this into their games. Beyond games, however, UI and UX designers must offer digital engagement solutions that pique the interest of clients in cryptocurrencies.

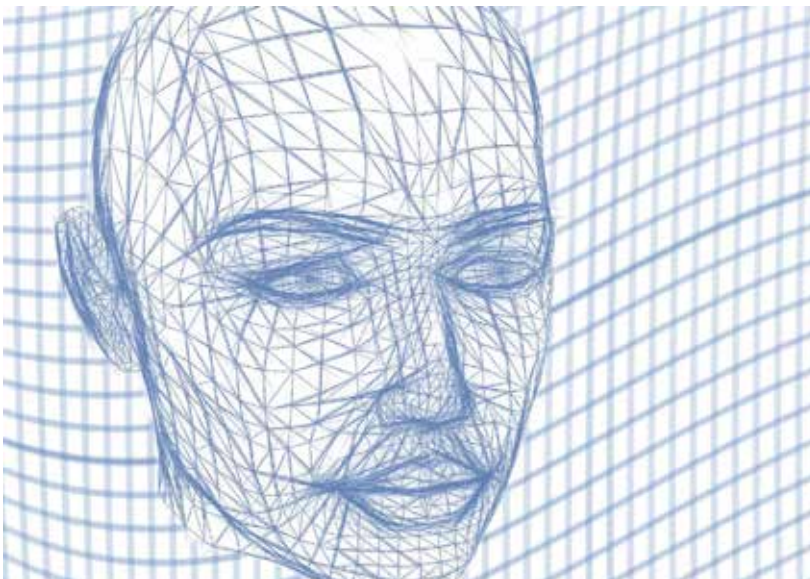
Concerning the relevance and use of UI and UX in the Metaverse, it is a platform-dependent framework that combines design thinking with immersive technology. Without UI and UX, clients will simply be spectators in the Metaverse, as opposed to continuous members who engage in this virtual environment. The design of the UI and UX will let users explore the Metaverse's many portals and interact with this virtual world.

The essence of UI and UX is essential for Metaverse

- Incorporating visual schemes: The Metaverse's aesthetic architecture and scheme are aided by UI and UX. The games and digital items must be enticing to millennials and Generation Z users. The mix of colors, iconography, and visual entities should be graphically pleasing in order for consumers to dwell and actively engage in the Metaverse.
- Streamlined and intriguing interface: The user interface is the differentiator between 3D video games, 360-degree videos, and the Metaverse. The VR

games of Metaverse combine the RPG gameplay format with an improved visual interface to provide a fully immersive experience. The audience is interested in experiencing emotions while playing the game, as opposed to being passive participants in typical video games. Metaverse's user interface is realistic, allowing consumers to return to the platform. A number of brands are analyzing user behavior during gameplay to create even more personalized and dynamic gaming interfaces.

- Empathy and fundraising for a cause: Through immersive UI and UX designs in the Metaverse, non-profit organizations may evoke in their customers a sense of empathetic concern for charitable causes and societal context. It may facilitate a more engaged mentality and attitude adjustment. Stanford research has previously shown the effectiveness of VR for fund-raising, and Metaverse will take it to the next level. UNICEF is collaborating with Metaverse to virtually link and exchange materials and transform the platform into a frontier for child rights education and assistance. Metaverse will be more than just a place to play games and see ads. With the help of UI and UX applications, it will be able to solve global problems, starting



▼ Stanford research has previously shown the effectiveness of VR for fund-raising, and Metaverse will take it to the next level. Through immersive UI and UX designs in the Metaverse, non-profit organizations may evoke in their customers a sense of empathetic concern for charitable causes and societal context. It may facilitate a more engaged mentality and attitude adjustment.

a trend of buying virtual items that help save the environment and even serving humanity with portals for fundraising and sharing resources.

The architecture of experience and interface in Metaverse

Just like architects are responsible for building structures, the furnishing of graphical marvels and other environments is virtually done by the UI and UX designers. They are the architects of the metaverse world. To efficiently design for the metaverse, UX experts are using new 3D modeling

techniques, such as Tvorì and SketchUp, that strengthen modeling, design, and development in a 3D virtual environment.

Traditional marketing methods are no longer effective as virtual immersion grows in tandem with the metaverse. To remain on top of the online competition, interactive interfaces and communicative experiences are a basic necessity, and UI and UX design will be at the helm of the evolutionary stretch of metaverse. ■

The author is Co-founder & MD,
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India poised to be at the center of metaverse-based gaming

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Being the world's top gaming market, India is likely to emerge as a hot destination for metaverse apps also and once metaverse starts powering the future of gaming, it will create new business opportunities for software vendors, device vendors, and game publishers too in the process

The government of India envisions a bright future for gaming in India. A task force for the Animation, Visual Effects, Gaming, and Comics (AVGC) sector has been announced in the Budget 2022 to fulfill that vision. Being the world's top gaming market, India is likely to emerge as a hot destination for metaverse apps too, feels **Rituparna Mandal, General Manager, MediaTek Bangalore**. She explains how metaverse is likely to impact the future of gaming in India and how MediaTek is gearing up to deliver the most advanced chips technology and solutions to the metaverse ecosystem.

▼ Opportunities unleashed by the Metaverse

The term "metaverse" was coined by Neal Stephenson in 1992, who visualized it as the next digital evolution after the Internet, where the real and virtual world will virtually merge. Now, after three decades, that virtual reality (VR) concept has become a reality with a potential to add innovation and value to every aspect of living.

In simple terms, metaverse is a network of 3D virtual objects interacting with each other, but on a broader perspective, it is a combination of technologies including AR/VR, blockchain, AI, animation, comics, online gaming, and social media.

Metaverse introduces several possibilities for consumer and business segments. Some of the top applications for consumers include gaming, social media, virtual shopping malls, virtual events/shows, real estate tours, immersive online classrooms etc.

For businesses, top applications include: virtually augmented workplace for better engagement and collaboration; training platforms for medical, military and research; augmented reality ads for better impact; digital humans to perform multiple tasks such as onboarding employees, customer service, sales, and other business interactions. In fact, a survey by Unsupervised, an analytics automation company, reveals that 61 percent of the markets want to market their brands in the metaverse.

For industries, metaverse in the 5G/6G era will open new opportunities with trends like Industry 4.0, Web 3.0, and NFTs. For telecom operators, metaverse opens new opportunities to deliver value-added meta services. A report by Credit Suisse has found that the new digital ecosystem



RITUPARNA MANDAL, General Manager, MediaTek Bangalore

in metaverse will push data usage by 20 times across the globe by 2032, further expand screen time and drive more bandwidth consumption.

Metaverse is perceived as the next big opportunity for startup investments. Startups focusing on areas like gaming, blockchain & NFTs, social apps, entertainment, and analytics are gaining traction in India. India can also build opportunities in metaverse-related software exports. Goldman Sachs estimates \$8 trillion metaverse opportunity for s/w exports for Indian IT cos.

▼ Metaverse powering the future of Gaming

Much before metaverse became popular, VR games like Minecraft and Roblox had captivated scores of young gamers. The immersive gaming experience delivered by AR/VR and the rapid growth of devices powered by AR/VR and XR has further accelerated the growth of metaverse to the current level. Meanwhile, the growth of high-speed Internet has acted as the catalyst driving this transformation. While VR heads top the list of gaming devices in the metaverse, mobile phones, gaming PCs, gaming consoles and hearable/wearables are also evolving to suit the demands of metaverse applications.

Metaverse also blends games with other apps like live streaming, cryptocurrencies and social media, creating several possibilities for players to transact across the ecosystem chain. For example, gamers can use the NFTs/cryptocurrencies in metaverse to purchase digital assets, which they can preserve for another game, maybe from a different publisher. Thus players will earn greater value for money while also enjoying near-real

world gaming experience with possibilities never imagined before. Thus metaverse also has the potential to promote eSports and create several gaming professionals.

Being the world's top gaming market, India will emerge as a hot destination for metaverse apps. As per the April 2022 statistics from SensorTower, India stays at the No. 1 position for global game downloads, which accumulated approximately 783 million installs, or 16.6 percent of total worldwide downloads. Metaverse will help the gaming market in India to flourish further by creating business opportunities for software vendors, device vendors and game publishers also in the process.

▼ Building blocks of the Metaverse

The four key building blocks of metaverse include software, hardware, supporting technologies and network infrastructure.

Gaming software tools, game engines and software libraries help in the creation of assets, characters, gameplay physics, icons, sound effects, help screens, buttons, and much more. In metaverse games, the software becomes more sophisticated in order to support advanced technologies like AR/VR and cryptocurrencies and advanced movements like tactile sensation in a 3D environment.

Metaverse hardware will be dominated by AR/VR headsets, but other devices like mobile phones, gaming PCs and gaming consoles also grab fair share by supporting standalone VR gaming applications. Already there is a belief that future smartphones will be replaced by AR devices, and personal computers could be replaced with VR gadgets. However, in order to turn that dream into reality, the technology and components should be improved drastically so that they can achieve the price-to-performance standards acceptable to average users.

With regard to metaverse technology, both hardware and software technologies come into play. Being the fundamental building blocks, processor technology emerges as the most important in this domain. MediaTek is focusing on this line. Apart from this, hardware tech associated with display and computing units also plays a significant role in building the metaverse ecosystem. As mentioned before, metaverse also blends AR/VR, blockchain, NFTs, IoT, AI and Analytics. Among these, NFTs garner massive

interest due to the impact they can bring to the gaming economy.

Networking technologies, last, but not the least, act as the backbone of the metaverse. Like the Internet, metaverse has the power to sweep the entire universe, so connectivity is integral. In India, metaverse is expected to thrive in the era of 5G, provided that the government and the operator community clear the way for ample investment for the effective utilization of the 5G spectrum.

▼ How Mediatek is gearing up for the Metaverse era

The metaverse era demands higher computing power and a low-latency network environment to enable large amounts of data transfer with better graphics capabilities. This will create the demand for more computing resources like storage and CPU/GPU and advanced network capabilities like 5G, WiFi 6 and higher.

With over 25 years of experience in the chip industry, MediaTek has the advantage of using its IP and resources to develop platforms to support the latest trends including metaverse. MediaTek's chipsets are already capable of offering metaverse capabilities in terms of processor speed, computing power and power consumption.

Mediatek also has gained an edge in 5G, multimedia and network capabilities. For example, the latest 5G chipset Dimensity 9000 that is built on TSMC's 4nm processor technology features an octa-core CPU and an Arm Cortex-X2 that bursts to epic 3.05GHz, while large, layered caches in the chip and the latest LPDDR5X memory makes data immediately available, eliminating the wait to give immediate responsiveness in any app, while also improving overall power efficiency to an unimaginable level.

Metaverse will mark a new beginning for the devices ecosystem, not just the VR headsets but other wearables too. Since metaverse requires a lot of chips with extreme performance capabilities, a number of innovations are expected in chip technologies in the coming years. There will be huge demand for processors and high-performance chip components, especially those that support the latest and upcoming generation of networks like 5G, 6G, WiFi6 and higher. Being a leader in chip innovation, MediaTek is prepared to deliver the most advanced technology and solutions to the metaverse ecosystem. ■

The Metaverse can shake up Digital Commerce forever

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Even though the Metaverse, and Web 3.0 concepts are still evolving, some of the use-cases like immersive commerce, NFT-related use-cases look very promising in terms of solving some of the long-standing challenges faced by the e-commerce companies as well as in creating new revenue streams

Indian e-commerce major, Flipkart has recently announced its innovation arm, Flipkart Labs in order to test and shape the future of digital commerce with new, emerging, and immersive technologies such as Blockchain, Web 3.0, and Metaverse, etc. Flipkart acquired AR/VR startup Scapic in 2020, and since has been experimenting with the idea of immersive shopping experiences which are likely to snowball further under this newly formed Flipkart Labs umbrella. We spoke to **Naren Ravula, VP and Head, Product Strategy and Deployment, Flipkart Labs** to know how the metaverse can take e-commerce to a whole new level.

▼ **How brands, sellers, and buyers on the e-commerce platforms are likely to benefit from embracing Metaverse and Web 3.0-based solutions?**

Brands and Sellers will continue to evolve their approach to interfacing with consumers. The metaverse now offers a newer, more immersive medium for brands to experiment with different kinds of content and commerce. The growing importance of virtual characters or avatars in recent times presents various business opportunities in e-commerce. Consumers now expect a combination of in-store and digital experiences, and the metaverse offers the ability to engage with brands and products using a personalized avatar.

The metaverse has already become a playground for luxury fashion brands, with some launching their new collection in the virtual world and others partnering up with developers to create their own bespoke games. In the near future, we anticipate more brands to follow and break the boundaries between virtual and physical reality to create more innovative, meaningful interactions with consumers.

We are in the very early days here and our team will be working on many different pilots and experiments. There are several use-cases for Web 3.0 in e-commerce. For example, brands looking to connect with loyal users and fans can provide additional value by way of gated commerce-enabled through NFTs. At the same time, brands and artists can use NFTs to build and monetize communities. We can



NAREN RAVULA, VP & Head, Product Strategy & Deployment, Flipkart Labs

create immersive shopping experiences in the Virtual Worlds/Metaverse, an ever-expanding world of real-time, with the help of virtual spaces in 3D. We can also enable e-commerce landscapes based on the Blockchain that will allow anyone to trade physical products on-chain.

▼ **What kind of challenges have you come across so far in embracing them and how are you addressing those challenges?**

Providing the same immersive experience for hundreds of millions of users in the Metaverse simultaneously is tough. The current smartphone device has limitations in terms of CPU/Processing power. Several global tech players are trying to build an AR/VR/MR headset, relying on the assumption that 5G technology will scale rapidly underneath.

The current growth of Web 3.0 appears to be constrained by high barriers to entry, and all have some problems in common. Deep technical knowledge is required, and we are working with a Dynamic Regulatory environment. The high network fees may discourage new users and the user journey might also prove to be difficult requiring multiple steps and accounts. It also poses a question on sustainability and energy

wastage and therefore could contribute to a bad carbon footprint.

At Flipkart, we are trying to solve the above by looking to build products in the space that are user-friendly, abstract away the technology, and comply with the existing regulatory standards.

▼ How do you see the application for Web 3.0 and Metaverse evolving in the coming years?

While Web3.0 and Metaverse proponents believe that it will one day replace Web 2.0 and offline physical interactions entirely, that's not likely going to be the case. Instead, a more likely future will see a spectrum where Web3.0, Metaverse co-exists alongside Web 2.0, physical offline activity. The metaverse will create a different digital identity that's in 3D and most likely an Avatar that can allow users to immerse themselves in ever-expanding worlds of real-time, virtual spaces.

Participants will be able to create, buy, socialize, and sell goods in these spaces. An entire economy that's built on-chain is



transparent, trustless, and immutable and will power these interactions and transactions. This will be powered by tokens, both fungible and non-fungible. Education and Learning, Fitness and Entertainment, and The Future of Work will all have applications that will have their alternatives in the virtual world.

Some of these applications will be built to run openly, almost without any interruption from a single community or company. These Decentralized Autonomous Organizations or DAOs are self-regulating and decentralize decision making through incentive alignment with native currencies. They can enable greater “stakeholder” participation in decision making through voting mechanisms.

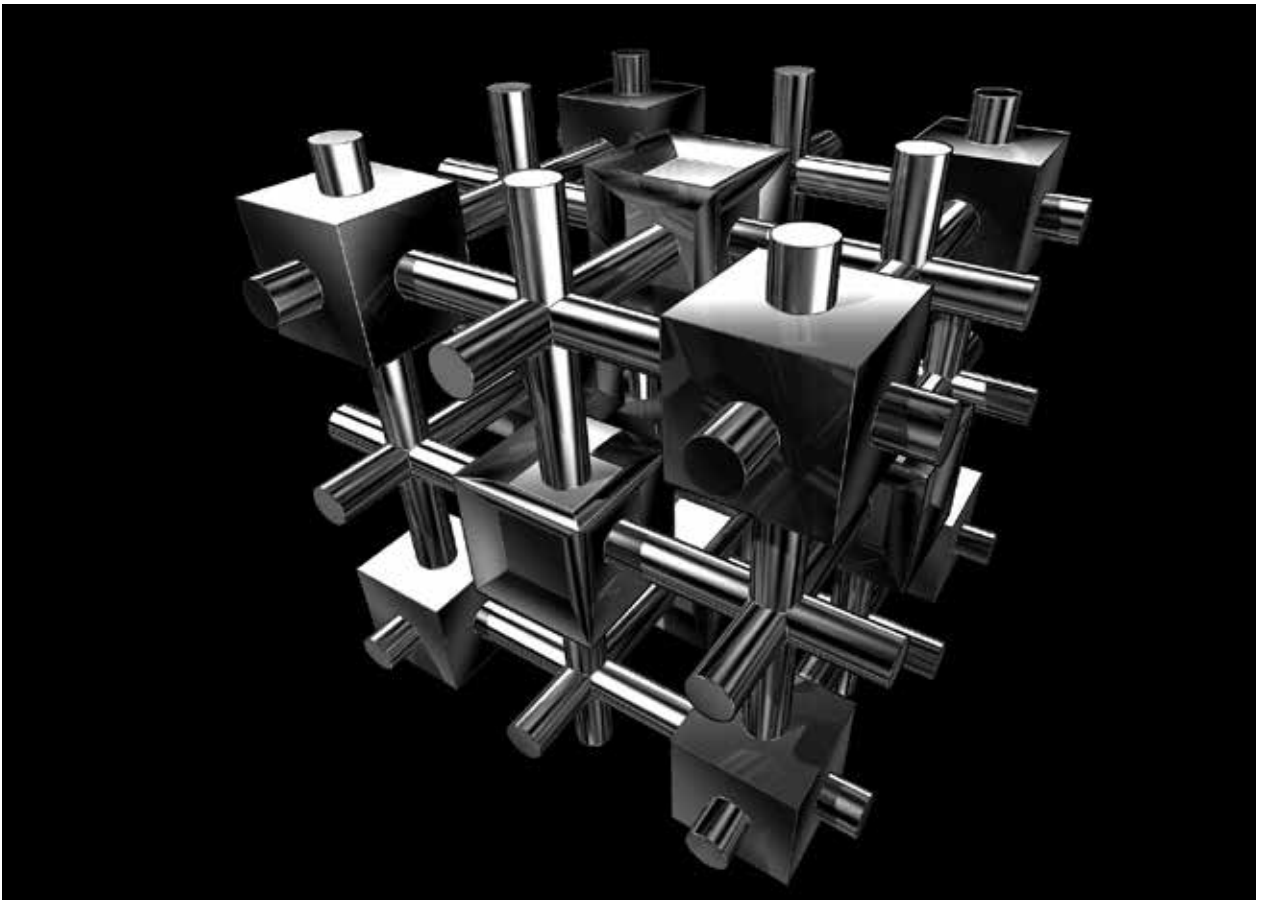
The exact shape or form of these applications will be shaped by many storytellers, developers, designers, community managers, and DAO founders, and that's what makes this space so exciting! ■

▼ While Web3.0 and Metaverse proponents believe that it will one day replace Web 2.0 and offline physical interactions entirely, that's not likely going to be the case. Instead, a more likely future will see a spectrum where Web3.0, Metaverse co-exist alongside Web 2.0, physical offline activity.

Bringing ideas to life faster on the Metaverse

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Metaverse Foundry services offers businesses the on-demand ability to securely and efficiently create their own metaverse environment by letting them choose from the already existing templates of ready-to-use Metaverse use cases and execution roadmaps as well as letting them work with the creator-partner in the Infosys Innovation Ecosystem

Businesses must know that there is no one-size-fits-all metaverse solution. The metaverse solution must be developed after careful consideration of the organization's unique business context, customers, partners, and even regulatory environment. Working with an experienced partner who will chart a suitable roadmap to the metaverse, based on these considerations, is also important. We spoke to **Ravi Kumar S, President, Infosys** to know more about the trends, and how Infosys Metaverse Foundry services help to fast-track enterprises' exploration of the metaverse.

▼ **Since Metaverse has become a buzzword these days, how are businesses across industries trying to embrace the Metaverse trend?**

The metaverse market opportunity is projected to reach \$800 billion by 2024 – undoubtedly making it the next generation of the internet, experiences, and physical-virtual connections. This opportunity is supported by emerging technologies such as blockchain, virtual reality (VR), and artificial intelligence (AI). Every industry is looking to join the metaverse bandwagon to create value for their customers, workplace, products, or operations. From retailing NFTs to building engaging environments and digital replicas while facilitating integration with enterprise data APIs and 360/3D asset management systems – retailers to engineering companies and manufacturers are looking to respond to this rapidly evolving space and opportunity.

In terms of use cases, gaming companies like Roblox, and Epic Games are leading the way, with their existing virtual environments and established user base. We are seeing early adopters driving commerce, transforming workplaces to create interactive, and productive work environments. We have also seen automotive companies talking about creating digital twins on the metaverse, and consumer goods companies exploring the possibility of co-creating and innovating on the metaverse. Similarly, the metaverse is also going to be increasingly leveraged by retailers, banks, and entertainment firms. We expect to find a lot of activity surrounding



RAVI KUMAR S, President, Infosys

cryptocurrencies, NFTs, and the ability to create a financial system in the virtual world. In the healthcare industry, the metaverse can be used to enable medical imaging, amongst other use cases.

We believe that value derived from the metaverse is limited only by a company's imagination and are confident we will begin to see all industries benefiting from the use of metaverse technologies over time.

▼ **Where are we now in terms of actual implementation?**

Over the past four years, Infosys has extensively focused on enabling the digital transformation journeys of our clients and solving their problems. In this line, around 7-8 years ago we started investing in metaverse technologies like enterprise AR/VR, followed by XR, and blockchain. The confluence of these technologies with IoT, Applied AI, digital twin engineering, and cloud, provides enterprises the ability to build for/on the metaverse. Through these investments, we have been able to successfully create value for our clients on the metaverse. For example, at the Australian Open, we created an immersive retail environment allowing fans to purchase branded merchandise that were delivered

in the physical world. Similarly, for a leading pharmaceutical, we created a digital twin of their vaccine lab enabling quality engineers to access critical vaccine culture data to make predictions and decisions. More recently, we have developed complex capabilities related to gaming, CAD, and open-source frameworks for creating on the metaverse. Our 400-500 people-strong team has developed over 100 ready-to-apply use cases and templates that our clients can leverage along with the Infosys platforms to navigate the metaverse.

While we are in the early stages of implementation, we do see new opportunities as many of our clients are actively looking at exploring the metaverse to drive value for their business.

▼ What are some of the hot skills required for Metaverse?

A wide range of skills are required to deliver on the metaverse, and the list continues to evolve. Complex skills related to AI, blockchain, gaming, engineering with CAD tools, and even open-source are useful, but perhaps even more important would be the ability to problem-find, rather than simply problem-solve. The metaverse offers us a canvas to address business problems with solutions that are not yet templated in thousands of ways – as they are in more traditional spaces. This is our opportunity to create those templates – and that is a job for those with an aptitude for problem-finding and framing to be followed by robust solution building.

▼ How can Metaverse Foundry services help? What are some of the important Metaverse building blocks, tech, and solutions under it?

The Infosys Metaverse Foundry will enable enterprises to ease and fast-track their exploration of the metaverse, including virtual and augmented environments, for their customers, workplace, products, and operations. It brings together the company's industry domain and design expertise, platforms, and digital accelerators, with strong relationships in a rich creator-partner economy. The foundry is equipped with 100

ready-to-use use cases, business cases, and execution roadmaps, helping enterprises across industries find value in the metaverse and the flexibility to ramp up and down their explorations at will. Enterprises can utilize the already existing template to bring their ideas to life faster on the metaverse. This gives them the on-demand ability to securely and efficiently create their own metaverse environment, deliver signature experiences in an existing metaverse, and bring advanced AI-powered data analytics and simulations to realize their evolving aspirations as the internet evolves. The foundry harnesses the power of technologies like AR/VR, Blockchain, NFT, IoT, Applied AI, cybersecurity, and 5G to advance value exploration in the metaverse for our clients.

▼ Who are the ecosystem partners? Could you please talk about some interesting use cases powered by these partners?

Infosys works in tandem with an ecosystem of creator-partners to harness technologies like hyperscale cloud, AR/VR, Blockchain, NFT, IoT, Responsible AI, cybersecurity, and 5G to power the metaverse. Additionally, our metaverse technology investments, including platforms and accelerators enable the rapid creation of engaging environments and digital replicas, while facilitating integration with enterprise data APIs and 360/3D asset management systems. AI and engineering platforms to build digital twins of complex physical objects are also available to drive simulations.

With the Infosys metaverse foundry, enterprises can work in tandem with any creator-partner in the Infosys Innovation Ecosystem to manage the pilot-to-production ramp up smoothly or add more choices at the prototype stage to de-risk and future-proof investments. For example, an engineering consulting company took advantage of Infosys metaverse to prototype an immersive mixed reality workbench to inspect prospective engineering construction sites rendered as rich 3D assets. The capability was evolved and scaled for global use on Azure high-performance cloud with ready support from Microsoft, a long-standing Infosys partner. ■

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6 ways 5G & Metaverse are set to revolutionize life and commerce

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Metaverse along with 5G will help businesses build spaces that are highly immersive, hyper-realistic and unique. 5G gives metaverse the founding blocks to realize the vision of bringing physical and digital lives together

Metaverse is not just about a digital reality but it is also a digital economy where users will be able to create, buy and sell goods. This unique blend of our physical lives with digital twins is for sure set to revolutionize consumer behavior.

In e-commerce specifically, metaverse will aid augmented experiences for customers by combining the best of in-store experiences with the convenience of shopping from your couch. The immersive multi-dimensional ability to touch and feel the products and understand their attributes and features without stepping out of your home is a technological advancement like no other!

1. Cost optimization

Metaverse will transcend physical boundaries and help in connecting vendors globally. This easy access and collaboration for innovation, cost negotiations, etc. will help in optimizing costs for production and procurements of products. This will also help in quality control and supply chain transparency.

2. Easy collaboration and visibility

Digitization of commerce has called for increased virility in the processes not only from D2C but also in B2B. Consumers, retailers and manufacturers are looking for transparency. Metaverse will augment supply chain transparency with Extended Reality (XR) representation of the production process and distribution and sales model. This would



RAJNEESH D, Director, CABT Logistics

allow stakeholders and investors to gain key insights about lead times, transit times, delays, and even real-time shipping costs.

3. Warehouse operations

Metaverse with its hyper-reality will provide a digital reality where skill training, operations orientation sessions etc. can be helped without disrupting everyday processes. Businesses today are looking to increase time and cost optimization. These strategies often require re-organizing workflows that might lead to slight delays. This is where the metaverse will step in. Testing new adjustments and layout and lows digitally will not hamper work in the physical world thus increasing productivity. Besides this dynamic space modeling, racking optimization, slotting etc. with the metaverse will help in cost optimization, especially for micro-fulfilment centres.

4. Advanced analytics

Metaverse will enhance the shopping experience for customers by bringing virtual reality billboards, the digital presence of brands, augmented videos, etc. This change in marketing technique would also call for advanced analytics

specific to the metaverse. From understanding virtual avatars and their purchase patterns to advanced analysis of data, metaverse will help businesses in understanding, refining their target audience and obtaining maximum ROI.

5. Accelerated production

Metaverse provides a safe space for companies to test and generate prototypes without affecting the physical world. This would not only help companies save cost and time but also increase product quality and innovation. Trial production, testing, operation management, etc. can be simulated and verified before rolling out in the physical world.

6. Faster and safer logistics with 5G-supported Blockchain technology

In a nutshell, Blockchain technology is like a digital ledger, a framework that stores transactional records. For Logistics, blockchain enables smooth and integrated communication across complex supply chains. With 5G technology, logistics stands to gain increased security and speed. 5G-supported Blockchain technology connectivity allows for an efficient supply chain with transparency

and visibility even if the products are distributed across the globe. Innovative inventory management and seamless fleet management including managing time-sensitive freight with greater accuracy are also with the help of 5G. 5G is also expected to help in advancing safety enhancements like collision avoidance, vehicle connectivity, geolocation tracking, etc. helping with lower fuel consumption as well as increasing tracking between first-mile and last-mile to keep processes transparent, swift and safe.

None of the benefits mentioned above is possible without 5G. 5G gives metaverse the founding blocks to realize the vision of bringing physical and digital lives together. With the application of 5G in IoT and AI, metaverse can avail rapid connectivity speed, ultra-low latency and a wider bandwidth helping advance this concept. Offering low latency, reliable communication, roaming capabilities, mobility support and an enhanced render level of detail, 5G is helping businesses build spaces that are highly immersive, hyper-realistic and unique – be it for work or play and can be accessed by multiple people at the same time without congestion. ■

The author is Director, CABT Logistics



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Predictive Networks: A sharp nose for networking landmines

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What happens when the networking plumbing pipes of enterprises are filled with intelligence derived from AI? Better protection against outages? Faster response times for threat incidents? How, and what else? Let's find out

A ccording to a McKinsey Report 'the State of AI' 2021, predictive service and intervention appeared (18 per cent) among the most popular use-cases of AI adoption. As per Cisco Global Networking Trends Report 2022,

45 per cent of IT leaders cited responding to disruptions as the top network challenge for 2021. If only networking was a step ahead of the things that can go wrong! If only networking could learn from its past mistakes and gaps; and spruce up for more confidence ahead!

Looks like Cisco has taken up that challenge, and possibility, quite seriously. We met **Mohit Lad, Co-founder & General Manager, ThousandEyes (now part of Cisco)** at Cisco Live in Las Vegas this June and got a peek into this ambitious breakthrough. Excerpts.

▼ What spurred this idea? How did it take shape?

For years, we have been working on different AI models and algorithms to provide recommendations and root-cause analysis. The earlier version of this was in WiFi when the network started to sense particular telemetry and could control the network automatically. Over time, we have tried to take the next step and get to a point where we can predict what can go wrong. The pandemic was a pivot and it became useful to have eyes on end-point devices in a hybrid work culture. We have come to a point where we can learn from our past behavior with SD-WAN data and be proactive and not reactive. The company has been building and testing predictive software engines over the past two years. Early customer trials have shown Cisco's technology can predict issues with high accuracy, helping IT teams to drastically improve connected experiences.

▼ What can it do?

You cannot run from outages, but it helps to spot them early on. This also helps to reduce technology debt and create better flagging mechanisms. To top it up- It's not just about recommendations but how these recommendations would have played out had they been picked- in some cases.

▼ But can it help to handle curve-balls – if it's all about past data?

It's like forecasting based on past lessons. It's an engine that uses historical data so not much room for curve-balls in this use-case. However, for non-SD-WAN use-cases, there may be some curve-balls.

▼ How much of this ties in with Observability?

Observability is a broad term. Cisco has a full stack of Observability capabilities. We can address a variety of network-personas.



MOHIT LAD, Co-founder & GM, ThousandEyes (part of Cisco)

Observability is not needed as a practice, but if it's present, it helps in better troubleshooting.

▼ What about data itself being a limitation- whether in terms of volume or the one beyond your radar?

Data can become a limiting factor only if use-cases change. Thousand Eyes has a very good state of visibility into the organization with continuous measurement expertise. We also have a vision to expand to other SD-WAN technologies. It is quite cross-platform and vendor-agnostic – with a good view of what's happening inside the network.

▼ How does it work? How will this be offered?

Cisco Predictive Networks gathers data from a multitude of telemetry sources. Once integrated, it learns the patterns using a variety of models. It starts to predict user experience issues, providing problem solving options. So now, customers can decide how far and wide they want to connect the engine throughout the network, giving them flexible options to expand as they need. It can help network operators prevent outages, safeguard against attacks, and elevate the user experience – all while helping to increase network performance. Cisco plans to deliver predictive technologies across its portfolio in integrated, easy-to-use SaaS offers. ■

Harnessing AI & analytics to establish a smarter, more adaptive Supply Chain

Rakesh Prasad

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Businesses are looking to deploy adaptive Digital Supply Chains that are equipped to deal with uncertainties and can process and analyze vast quantities of fast-moving data from connected systems using AI/ML & analytics

Today's globalized supply chains have evolved to become highly interlinked and continue to grow in complexity. Widespread disruptions such as COVID-19 have elevated the need for autonomous, agile and resilient supply chains that provide end-to-end visibility and better operational control.

In addition to leveraging customer insights for marketing and promotions, organizations now also need to accelerate their exploration of analytics to create flexible digitally-enabled supply chain models. I believe there is significant value that can be realized to drive customer experience, revenue acceleration, risk prediction, and cost optimization. Artificial Intelligence (AI) and Machine Learning (ML) must be integrated with operations to draw actionable insights, predict events, and prescribe relevant actions.

I'm listing below some salient use cases on how AI-powered software can quickly process large volumes of data and define trends at granular level. These insights can then be fed to robotics and immersive digital technologies to create customized, scalable and secure Digital Supply Chains.

▼ Beyond Neurons: A cognitive pull based Supply Chain

Gartner predicts that by 2024, 50 per cent of supply chain organizations will invest in applications that support AI and advanced analytics capabilities. Forward-looking organizations can deploy adaptive Digital Supply Networks (DSN) that are equipped to deal with uncertainties and can analyze vast quantities of fast-moving data from connected systems. This will enable informed, timely and optimal decision-making leading to a smart value-driven network.

It is necessary to identify and include data sources that are closer to consumption. That's because traditional forecasting techniques associated with time-series methods are no longer sufficient to derive actionable insights. The recent chip shortage incident is an example where improper demand planning caused a tremendous ripple effect across the supply chain - a variety of products from cars to gaming consoles and refrigerators were impacted. AI-driven



RAKESH PRASAD, SVP- Digital Services,
Innover

Demand Sensing can increase visibility, accuracy and reliability across the value network by estimating dips and spikes in customer demand using near real-time information such as ecommerce or Point-of-Sale (POS) data across short time horizons to create accurate demand forecasts. Thus, granular insights into customer behavior and preferences can be derived.

Leveraging advanced AI and ML in this manner enables SKU rationalization by considering numerous factors like service levels, price point, bills of material and unit costs - to better anticipate demand. These techniques can also use external data sources such as economic indicators, weather patterns, competitive pricing and customer behavior to create daily forecasts that reflect current market trends and realities - thus delivering high service levels with optimum inventory. Demand Sensing can allow strategic item placement and storage in Forward Stocking Locations' (FSLs) or other pockets of inventory near customers, optimizing last-mile delivery for superlative customer experience.

An AI charter also leads to proactive risk management. It harmonizes supply chain data and applies self-corrections or learnings to both implement and enhance



human intelligence. Automated solutions and prognostic AI models allow proactive risk assessment and business impact analysis by simulating what-if scenarios in real time - such as identifying vulnerabilities and failure points in an organization's infrastructure. Using AI, supply chain organizations can make smart predictions about sourcing raw material, work-in-progress components, inventory reconciliation, invoice exceptions or errors, field maintenance, scheduling and tracking shipment and transportation activities, to name some.

▼ Using AI for Warehouse Optimization

Well-organized supply chain planning is usually synonymous with warehouse management and inventory organization. Accurate and faster warehouse item picking is essential for efficient order fulfillment. Significant digital transformation efforts are ongoing in this area. A key use case that supply chain professionals are interested in is route optimization within the warehouse to ensure most efficient item picking routes. By leveraging techniques such as visual analytics, RFID (Radio Frequency Identification) technology, advanced cameras on omn-directional forklifts, and analyzing the weight and size of the items picked - innovations can be directed towards providing smooth navigation in complex warehouse facilities.

Another use case that is becoming critical for warehouse managers is asset management and prediction of failures in advance, especially in case of forklifts. Having Internet-of-Things (IoT) - enabled sensors on the forklifts that can analyze the torque, sharp turns, sound patterns, etc. will dramatically improve the failure prediction rates as well as optimize the drivers' handling of warehouse equipment. This capability has the potential to directly influence customer experience.

Warehouse Robotics has also gained traction in recent years as robotic arms can move, turn, lift and maneuver items, assisting human workers and increasing workplace productivity.

▼ Managing Suppliers and Global Sourcing Risks

AI can be a strategic tool for proactive supplier risk management and for driving responsible sourcing in global supply chains. Successful sourcing of data given geopolitical risks, natural disasters, strikes and black-swan events like COVID-19 plays a critical role

in ensuring business continuity. The traditional methods of just using supplier on-time delivery and historical performance is not adequate in black-swan events. AI-powered supplier risk modules support supplier lifecycle management - including supplier selection, supplier profiling, and supplier

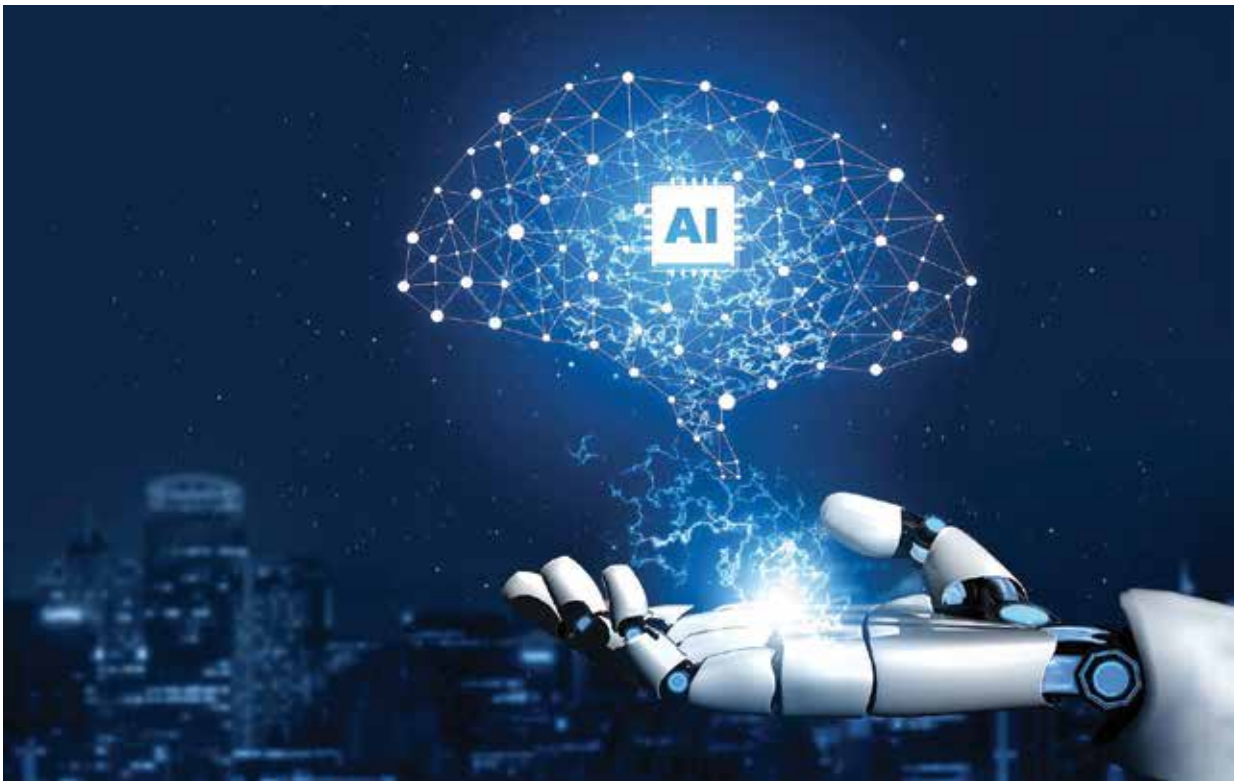
categorization based on geography, reach, criticality, pricing options and other standard business metrics. This enables firms to rank suppliers on the basis of risk, efficiency and overall performance. For instance, during the pandemic, suppliers in most affected geographies will be assigned a "high risk" level. AI-enabled organizations can also work through contingency planning to mitigate possible issues and develop alternative sourcing strategies, should their primary suppliers become unavailable. Another use-case that supply chain organizations can leverage for improved supplier management is keeping a log of companies' historical bids and creating predictive models for competitive pricing strategies.

▼ Applying AI to Logistics and Transportation

AI can drive efficiencies in the logistics and transportation realm in two major categories.

First category is about driving efficiencies

▼ Automated solutions and prognostic AI models allow proactive risk assessment and business impact analysis by simulating what-if scenarios in real time such as identifying vulnerabilities and failure points in an organization's infrastructure.



such as route optimization, aligning demand forecasting with optimal origin-destination pair, reducing dead miles, and reducing waiting times during loading/unloading. Dynamic programming can be used to identify the best routes. This helps categorize regions that attract the most demand. AI enables load optimization and time-definitive last mile delivery by considering vital factors such as ideal order-destination pair or lane, cross-docking information, product size and weight, due date of delivery, priority etc. Another use case of AI is related to enhancing in-transit visibility and traceability in shipping operations. There occurs a significant amount of wastage when shipment deadlines are missed and deliveries are to be rescheduled. Building AI enhanced order fulfillment models can ensure delivery of the right product or part in right quantities at right time, location and price, ensuring enhanced Customer Experience (CX).

The second category is about service order lifecycles. AI is reshaping sales order and service lifecycle operations by using dispatch algorithms and predictive analytics - driving better field automation, order re-filling, asset

utilization, tech performance, Service Level Agreement (SLA) adherence and automated appointment scheduling – leading to better revenue recognition, customer experience and cost savings.

▼ A future with AI

Resolute supply chain professionals are and will continue working through rapidly-evolving situations and challenges. While one cannot predict what might happen tomorrow, forward-looking organizations can build a responsive, future-ready and sustainable global supply chain by leveraging AI supported by emerging technologies such as Blockchain, IoT, Digital Twins, 5G, and Edge Computing. AI-led supply chain optimization can yield insights to drive systemic changes and monitor compliance and data quality standards. Smart decisions at every step of the supply chain are enabled by unlocking the power of data through AI. Sense, hear, envision, and respond swiftly to changes in the marketplace with AI and digital for exceptional customer experiences and greater supply chain resilience. ■

The author is SVP- Digital Services, Innover

Couples miss each other and that isn't always about sex

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Context, privacy, ergonomics, non-intrusiveness, battery life and deeply customizable nuances that only two partners can enjoy- these are just some challenges that a long distance bracelet has to snap well into. Let's try the Bond Touch and see how well it covers this distance?

*How can I keep my soul in me, so that
it doesn't touch your soul?
Yet everything that touches us, me and you,
takes us together like a violin's bow,
which draws 'one' voice out of two separate
strings.*

Upon what instrument are we two spanned?

Poet Rainer Maria Rilke may have written these lines way before the idea of emotional wearables had even been thought of. But today we have bracelets that can do exactly that- vibrate two deeply-connected people with the beautiful tremor of touch – thanks to the instrument called technology. One such company is Bond Touch- claiming that it is closing the gap between long-distance relationships by allowing each person to stay connected at all times through touch. Light-weight to wear, sleek and subtle- these are just the first impressions you get when you put the bracelet on your wrist. And as long as you are near WiFi and have a Bluetooth always-on, the promise of 'staying in touch' holds well. But there are many other what-ifs and how-s to be covered well in its grip before the bracelet throbs like a timeless poem. **Artur Ventura, Tech Lead, Bond Touch** helps us get deeper and closer to these questions.

▼ Tell us something about how this idea and product spawned- what were the struggles, highlights, lessons etc.

Bond Touch spawned from a real world use case. Kwame (our CEO), together with his business partner at the time, while on business trips away, felt they missed their loved ones back home, particularly their wives. They know that they could easily just send them a message through their phones, but it doesn't mean as much as things like a physical embrace. Their desire for this led them to develop Bond Touch for those who thought the same: a simple wearable to allow users to feel closer to their remote loved one. Since then, Bond Touch has provided a handful



ARTUR VENTURA, Tech Lead, Bond Touch

of learnings. Growth was one of the biggest challenges. We've been a pretty small team with business growth that was always above our expectations. Keeping up with our growth operationally to maintain these expectations has always been a learning process. Besides this, our product is something relatively new and hard to compare to other products or markets, so we've gladly embraced the challenge of figuring out what an emotional wearable means to markets and its users.

▼ How much focus do you place on personalisation, on emotional connect, on meaningfulness - and how do these areas get translated in the product experience?

Our product teams at Bond Touch are super focused on what is meaningful to them. It's the most straightforward way to provide value to them through our work. Through his process we've grown to understand that the uniqueness of each users' experience is a very important factor. Personalization and focusing on a more emotional connection are important means to maintain a significant usage that is relevant and unique to each and every user. We've enhanced this through things like providing a variety of colours of Bond Touch and its accessories for users to buy and allowing users to choose the light colours used when sending and receiving touches through Bond Touch. More importantly, however, has been our most recent in-app

feature which we call Touch Language.

▼ **Can a user create one's own secret language beyond the basic alerts that the bracelet provides?**

When talking to users we realized that they would frequently use notebooks to write down message patterns that meant specific meanings to both them and their partner. Keeping this in mind, we developed Touch Language to allow users to be able to not only manage meanings given to touch message patterns and apply custom gradient colours to them, but also developed an algorithm that detects if touch messages sent and received matches Touch Language meanings saved previously and apply the customization (gradient colors and what the message means) in real time. The feature proved to be well adopted by our users, having a quarter of all touch messages sent with a meaning applied to them.

▼ **What makes you different from other such offerings - in the wearables space as well as ideas like Durex Long-Distance Fundawear?**

We consider ourselves significantly different from other wearables. So far very few are anywhere close to what we provide. Looking at wearables as a whole, many focus

on multi-functionality: they're watches, heart rate monitors, they have screens and provide the user with much to do. The products we develop are simplified and focus on what matters: proximity to the relationship they miss dearly. When you receive a message through Bond Touch or through the upcoming Bond Touch More, you know that it's a loved one thinking of you, and nothing else. This simplicity and relevancy makes the product special to our users and that makes us stand out. Not trying to overload our users with anything but their partner's touch is our

▼ Not trying to overload our users with anything but their partner's touch is our strong point

strong point. Specifically regarding the Durex Long-Distance Fundawear, our product does not focus on the sexuality of relationships, but a more emotional aspect of the relationship between couples. Couples miss each other and want to feel their loved as if they were there, and that isn't always about

sex. Sexuality is an important point, of course, but our product doesn't cover that area.

▼ **How can a user ensure discretion, privacy and assurance against public attention while using such a product- specially for celebs? Also, what is the policy on first-party and third-party data usage here?**

We are a privacy-first company. Our service provides 'end to end' privacy. It is not possible for us to know the content and of the information shared between partners. Only the elements in that relationship can decode the message. Also we only retain the message encrypted content while in transit and it is scrubbed from our systems on delivery

The wearables segment has been facing both opportunities and challenges in its learning curve so far- how grave are issues like form factor, ergonomics, miniaturization, PAN (Personal Area Network), and lack of a good app despite presence of robust hardware etc.

Form factor and ergonomics are by far the most important factors when building a wearable. You're trying to optimize for multiple variables, and trying to find the sweet spot.



Smaller and speaker devices do make great products for a person to wear but you would be paying a price in battery budget. And no one wants to charge their devices more than once a day. That is the tightest rope to walk in this segment.

▼ **How soon would we see advancements in tactile sensors (like deformability, signal analysis, data feedback, sensitivity) being manifested into actual products?**

We would like to have Moore's law for material sciences but the reality is that innovation in that sector cannot be compared with computer science. During the development of Bond Touch More we have tested a lot of incredible technologies that work inside of a lab but when moving towards engineering a product some of them have not matured enough to be used in the field. Sometimes it is a yield problem, others are in the field failure rates. There are some interesting things in the pipeline but they are still a few years away.

▼ **Can we expect any possibilities of self-learning and evolution by AI/algorithms in such products to further integrate deeply with a particular user context?**

One of the ideas we have been thinking about is using the technology these wearables have to estimate user context. One of the main anxieties of long distance partners is the lack of context on the other person's life. We are exploring ameliorating this feeling by predicting when the partner is at work, at home or in some other context.

▼ **Can this product find enterprise potential too- like remote workforce management, use in fire departments, rescue teams etc.?**

The emotional connection you have with your company and your coworkers is one of the main relationships one can have. People

leave jobs because of bad chemistry with the rest of the team. Remote work also aggravates this problem. Currently there are HR solutions to measure and estimate the employee satisfaction and eNPS scores. We have had internal talks if we can bring the lessons we have learned from the consumer space into the enterprise space. But we don't have anything to announce at this moment.

▼ **Are we inching closer towards the Internet of Humans in a way? Why or why not? How can we make it less dystopian?**

We are already living in it in some sense, just depending on your perspective. Cyborgs conjure images of flesh intertwined with metal, but in reality our own glasses are technological augments we build to improve our sight, hearing aids allow improved hearing, sometimes even achieving superhuman performance, and something as simple as an Airpod allows the user to through voice to access the total sum of human knowledge through

Siri. We are in a sense already cyborgs. The idea of an Internet of Humans already exists today. The initial versions of Bond touch can be viewed as cybernetic augment (as in Kolmogorov and Bateson) that helps the user improve its relationship. With Bond Touch More we are expanding this towards multiple relationships.

▼ **Any future tech jumps that you have envisaged - like use of AR, VR, Blockchain, decentralized data exchanges? Anything else exciting that we can expect next?**

There are some possible interesting uses for these technologies. Blockchain for instance can enable decentralized registry for things like marriages and NFTs can be used to generate tokens for important moments in a relationship, but some of these technologies are very recent and a lot of work is still needed. ■

Data Mesh: To Mesh or not to Mesh?

Dr. Anil Kaul & Harshit Parikh

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Data Mesh is a technology-agnostic distributed data architecture that makes the data discoverable, widely accessible, secure, and interoperable – giving businesses better decision-making power and faster time to value

In today's fast-paced, data-driven world, business operations are surrounded by a broad spectrum of data. However, the conventional data architecture is facing tremendous challenges in keeping pace with the rapidly changing demands and landscape of the contemporary world. This need gap paved the way for innovations. An advanced technique that can structure data storage, processing, security and delivery mechanisms in such a manner that it efficiently supports their growth, scalability and effectiveness throughout the operations of an organization.

Against this background, today we will unveil the answers to 4 most-asked questions about Data Mesh, a pioneering data architecture with promises to solve the aforementioned challenges:

Foremost, what is Data Mesh?

Data Mesh is unquestionably a dynamic and contemporary concept. Director of Emerging Technology and Thought Works and author of Data Mesh, Zhamak Dehghani, defines this term as a state-of-the-art response to the common problem of centralized, monolithic, and slow-moving data platforms.

A Data Mesh is a technology-agnostic distributed data architecture, where data resides with the team that originates or curates it while the relevant data insights are shared throughout the organization. Data Mesh has also been expounded as a set of principles for designing data architecture. The four fundamental principles are as follows:

1. Owned by one but accessible to all:

Data Mesh ensures that data is owned by a specific domain (the one which produces or generates it), but the data itself is accessible in a decentralized way. It simply entails that each business segment identifies relevant data that will be handy in other areas, ensuring that data is accessible to everyone.

2. Data is a product, treat it accordingly:

Data Mesh treats data as a product that is shared by the domain team. It is comparable to a standard product development process which includes research and experimentation about



DR. ANIL KAUL, CEO, Absolutdata (an Infogain company) & Chief AI Officer, Infogain

how a particular product can be used differently. Similarly, teams are responsible for thinking outside the box to predict how other departments, business areas, and end-users can utilize their data.

3. Data is available with necessary due diligence:

Data Mesh ensures that quality data is available throughout the organization with due regard to security and governance. Simply put, while data resides with the domain, department or team, other business segments can also access and apply it to create reports, and much more (depending on their requirements).

4. Data is governed at the source:

In the words of Dehghani, this principle can be summarized in three words – Federated Computational Governance. This is a boutique way of governing data that allows interoperability across domains, irrespective of their differences. By doing governance at a decentralized level, users tend to trust the source and are able to navigate data in the Mesh swiftly.

How is Data Mesh different from its counterparts?

Data Mesh allows teams to curate/generate data and create usable data products for other teams. It also makes certain that platform teams can put their efforts into data engineering while data professionals can handle domain-specific data issues. While business data professionals are responsible for the quality and reliability of the data their teams produce, they can take assistance from platform teams in the face of technical glitches.

Apart from that, Data Mesh design is inclined towards business users and requires relatively minor interference from platform teams. This is unlike centralized data teams that are responsible for everything, from data frameworks and access to dealing with data-related requests.

To conclude, Data Mesh or the decentralized architecture encourages each party to excel in their area of expertise. The platform teams need to focus on technology, engineering and data pipelines, while the data professionals are accountable for ensuring data quality.

▼ Data Mesh or the decentralized architecture encourages each party to excel in their area of expertise. The platform teams need to focus on technology, engineering and data pipelines, while the data professionals are accountable for ensuring data quality. This holistic approach ensures end-users can perform their tasks by leveraging data insights without investing time in acquiring the results of a custom request.



HARSHIT PARIKH, VP, Global Practice lead, Infogain

This holistic approach ensures end-users can perform their tasks by leveraging data insights without investing time in acquiring the results of a custom request.

What are the obstacles a Data Mesh helps to resolve?

Data Mesh equips teams and leadership with a data-driven mindset. It enables teams to access or agree on any given data of critical importance. It also ensures ownership, accountability and quality of data insights. It resolves problems like difficulty in dealing with data bottlenecks, slow or inefficient data pipelines, and hard-to-scale data ecosystems.

Furthermore, Data Mesh provides infinitely more sources of data. It also enables even large teams to function with optimized data sources and data-driven features. By leveraging Data Mesh, platforms can eliminate cross-collaborative team struggles and support each side's function. It can also stop any hindrance caused by the lack of domain knowledge. Data Mesh also provides organizations with detailed and thorough data for a myriad of regions and business areas.



What is the method of Data Mesh implementation?

It begins with a shift in thinking. For instance, incept from centralized data ownership to team-based data, from data as a secondary effect to a valuable product for and within an organization and from a single team managing a massive centralized data repository to domain teams doing the same but with the help of qualified data professionals.

Building a Data Mesh is a straightforward procedure. Start by including a central data stream platform in your foundation. This should consist of store data, independent publishing by a team and delivery resources as per user demand/requirements. Following this step, make certain that your data sources are iron-clad. In simple words, make sure they have clear owners (originators or curators of the data) as they will be solely responsible for publishing data on the Mesh.

In terms of security, a team-level establishment of data governance is crucial. Ensure that your platform is equipped to support dynamic scheme changes, connects with both owners and user databases,

provides data stream previews and lineage images, and can access requests.

The last but vital step is to implement an intuitive, hassle-free and user-friendly interface for business users. This will develop an efficient unified experience for ensuring users can get their hands on reliable data without facing any last-mile hiccups.

To Mesh or not to Mesh, that is the question

As explained above, Data Mesh is a technique that enables organizations to decentralize their data and provide meaningful insights to use more constructively. By integrating this new-age method, businesses and data platform teams can focus on their areas of expertise. As each team manages data independently, there will be more detailed governance, faster access and delivery, and better compliance with domain-specific/local regulations. In a nutshell, Data Mesh equips businesses to harness the power of their data efficiently, which can automatically assist them in making data-driven decisions and ensure an agile standpoint. ■

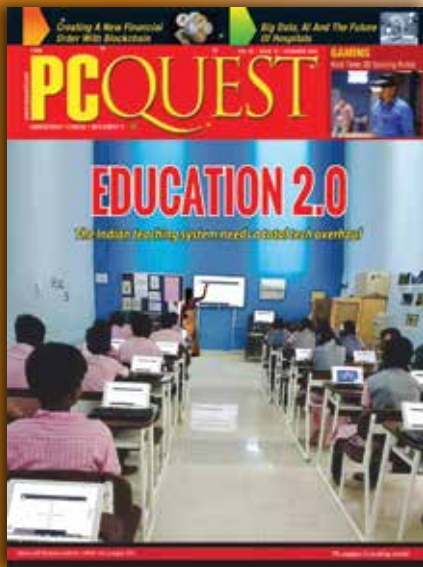
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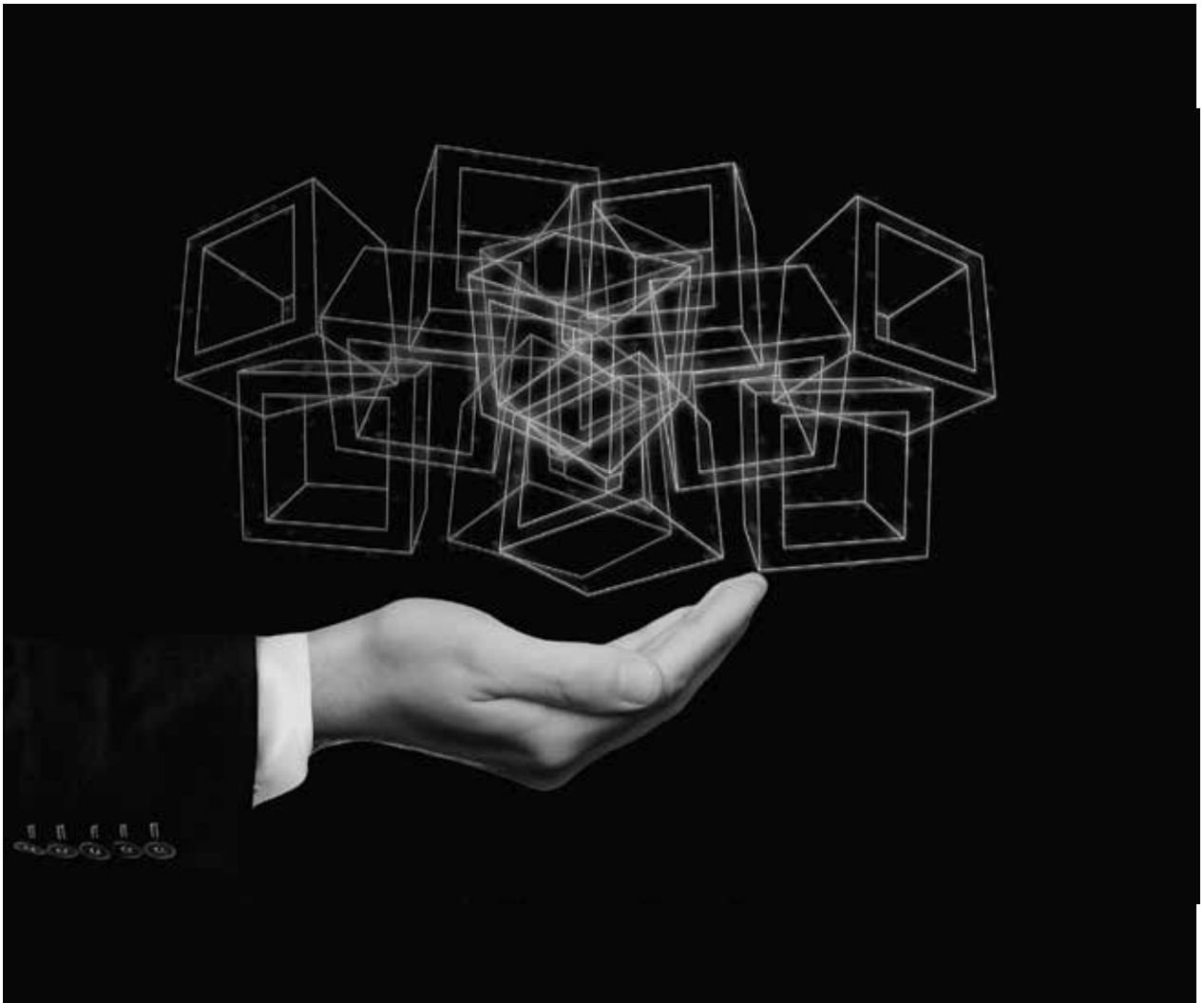
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The craft of Blockchain Patenting

Ramya Rao

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How can industries claim patents to protect innovative blockchain technology and what are the viewpoints of patent offices across the world?

Primarily proposed as a research project by Stuart Haber and W. Scott Stornetta in 1991, the blockchain concept predates its first widespread application in use as bitcoin almost two decades later, in 2009. In the years since, the use of blockchains has exploded via the creation of various cryptocurrencies, decentralized finance (DeFi) applications, non-fungible tokens (NFTs), and smart contracts.

Bitcoin uses blockchain as a mere means to transparently record transactions in a distributed ledger. But blockchain, in theory, can be used to immutably record any number of data points. For example, it could be used for transactions such as votes in an election, product inventories, state identifications, smart contracts, and much more.

Blockchain essentially is an amalgamation of various technologies. Its various innovative implementations reap benefits like improved accuracy by removing human involvement in verification, cost reductions by eliminating third-party verification, harder to tamper within view of decentralization, and secure, private, and efficient transactions.

The advantages of this disruptive technology have led to an increased filing of blockchain patents. The top ten countries or jurisdictions in the blockchain patent space are China, the United States, Korea, EPO, PCT, Japan, Taiwan, Singapore, Canada, and Australia. China is leading the space with 34,562 granted and pending blockchain applications. The United States is second in patenting with 8,759 granted patents and pending applications. Korea is third with 4,035 granted patents and pending applications in blockchain technology.

Patentability of Blockchain Innovation

Several courts across the world are especially critical of granting blockchain/cryptocurrency-related patent applications in their recent decisions. The basis of such decisions is that the invention is not patent-eligible subject matter since it is directed to a judicial exception. Particularly, in the United States, software and related cryptocurrency patent applications were



RAMYA RAO, Partner, K&S Partners

rejected as “abstract” and found to be simply “organizing human activity” or merely using generic computer functions. Under the requirements of 35 U.S.C. 101, applicants must demonstrate that the technology underlying the software has been modified to achieve a specific result.

Indian Perspective

Theoretically, it has been hinted that blockchain-related innovations may not be patentable because most blockchain-based services are using the same old technology (blockchain) for a new application or use. The essence of blockchain technology revolves around algorithms using mathematical theory and/or computer programs. Algorithms and computer programs may not be deemed inventions in the sense of Section 3(k) of the Indian Patents Act.

Recent patent grants by the Indian Patent Office (IPO) suggest that computer-related inventions are patentable under Section 3(k) if they give a technical solution to a technical problem by providing a practical application or an improved technical impact of the underlying software. This could suggest

that a blockchain-based invention may be patentable if it provides a technical solution to a technical problem and significantly enhances the underlying technology. However, since there is no common guideline of what amounts to an improvement, as of today, patentability may be ascertained on a case-to-case basis at an examiner's discretion.

As per the IPO website, there are approximately 1,446 published patent applications and 27 granted patents in the field of blockchain, in India. Upon analyzing these patents, it was found that a majority of these relate to improvement to the blockchain technology itself, followed by a handful of patents granted for secure network communication and legal systems. Other verticals include agriculture, advertisement, pharmaceuticals, finance, automotive and e-commerce, and the healthcare industry.

A good example is a recent patent grant in April 2022 by IPO which demonstrates how the government is promoting the innovation of blockchain technologies. Patent application 202011044603 is related to a method for improving advertisement efficiency through the implementation of blockchain technology. It is interesting to note that both - the technology used in the invention, blockchain, and the field of application, advertisement, are very complex areas to have patents granted under the computer-related inventions (CRI) guidelines. The invention shortlists a suitable advertisement platform comprising various criteria such as nature of the advertisement, target audience, geolocation, nature of the digital platform, a threshold false activity allowance, etc.

The technical advantages highlighted by the applicant to circumvent non-patentability under section 3(k) were automated assessment of a suitable advertisement platform based on parameters such as a history of impressions, click-through rates, and user traffic on the platform, the validity of the platform and transparency for placement of the advertisement. In addition, the applicant highlighted that since advertisements are placed on selected advertisement platforms, the invention

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requires less hardware space/memory unit and saves significant processing power. Finally, the requirement of hardware components was satisfied by illustrating how the communication is happening between a central server and multiple local servers for the assessment of the digital platform.

Things you must keep in mind

In a general sense, any blockchain innovation which involves improved technological functionality or produces a tangible result can be considered a patent-eligible subject matter.

It is important in patenting blockchain innovation to craft a well-articulated claim set and detailed description that demonstrates how the novel blockchain technology improves computer functionality and/or employs a technical solution to a known technical deficiency. The patent application should include a clear and thorough analysis and description of all systems, subsystems, and components that implement this proprietary process or method. ■

The author is Partner, K&S Partners

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HP SMART TANK 750

PRINTER

Price: ₹ 23,147

Nowadays, most of us prefer to capture and store our memories on our smartphones and due to the COVID-19 pandemic, most offices are preferring digital rather than print documents. Yet, there are a few things which we love to explore in the real world. We love to print images of some special occasions. Similarly, at the office, we must have a printed document for certain procedures. So you can't completely do away from printing and to do so you need an efficient printer.

▼ Build and features

The AIO is a compact machine measuring 427.54 x 364 x 240.25 mm, that can easily fit in a corner or on a table. Weighing around 7.70Kg, one can easily move it around. When you open the printer box, it contains regular cables and four ink bottles. When you set up the printer, can fill in the colors easily to the tanks with its spill free refill system.

The printer has a quick and easy set up enabled by dual-band Wi-Fi. It comes with Bluetooth Low Energy (BLE) and HP Smart App that lets you operate the printer from your mobile devices; allows easy mobile scanning and printing. The HP printer comes with numerous security features.

▼ Setting up

It would take hardly a few minutes to set up the printer, if you are well versed with the connectivity, cables and color refilling, etc. It doesn't require any technical knowledge. Simply take out the printer, and remove all the protection films/papers, then plug it to power. Insert the print heads, it's like inserting a cartridge into the printer. Using the color bottles, fill in the colors in the respective tanks.

▼ Performance

We used the HP Smart Tank 750 printer for around a month to test its printing capability. In our standard ISO test with 5% ink coverage, it printed 5 A4 color pages in about 1 min and 06 sec with the first page out in 15 seconds. While printing

**Overall: 8/10**

SCORE

PRICE: 8/10

PERFORMANCE: 8/10

FEATURES: 9/10

KEY SPECS

Print, Scan, Copy, ADF, Wireless; Print speed up to 23 ppm (black) and 22 ppm (color); USB, WiFi, Bluetooth, LAN, Mobile Printing; Get up to 12000 black pages or up to 8000 color pages; Dual-band Wi-Fi; HP Smart app

PROS:

Compact design, Smart app for wireless printing and scanning, 35-page auto-feeder, smart-guided buttons

CONS:

A little slow while printing color pages

100 pages, it took 16 min 03 secs. We got 1 photo page print in approx 2 min 41 sec of A4 size with the best DPI and 6X4 inch photo out in about 56 sec with 300 DPI. When we used duplex printing, it took around 29 sec to print both sides. In standard text printing, it was able to meet the 21 pages per minutes (black) print speed. But color print speed wasn't close to what was claimed, it was around 14 pages per minute.

The test included text pages, graphics pages and pages with mixed content for both black and white. The output quality is excellent, and the text looked sharp and detailed. The print quality of the image comes with a good amount of details and sharpness.

The optical resolution of the scanner is 1200 dpi (dots per inch is a unit of optical resolution). It scanned an A4 image in just 19 sec with a good amount of details and took around 4 min 40 sec at 1200 DPI with a whole lot of details and vibrant colors, and only 41 sec to copy an A4 page. ■

Bottomline: The compact machine offers numerous amazing security features. The document print cost can be as lower as 10 paise per page and print speed is also good. However, it is a bit slower when printing color pages, yet it's perfect for home and small/medium office setups.

VINGAJJOY
JERRY SERIES
SP-12 WIRELESS
SPEAKER

SPEAKER

Price: ₹ 649

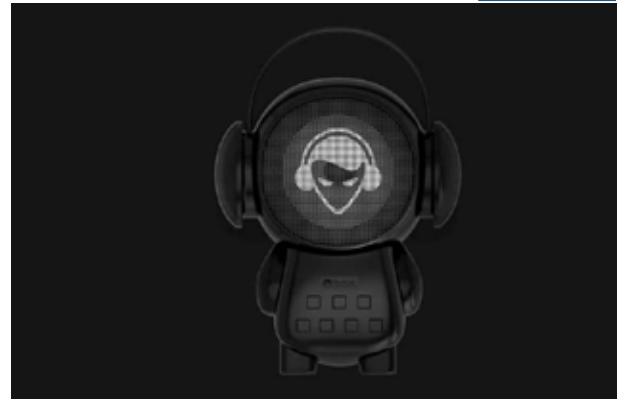
Vingajoy's all-new SP-12 Jerry Series Wireless Speaker looks completely different from any traditional wireless speaker. With an ergonomic design that looks like a small robot, the mini speaker boasts numerous features and decent battery life of four to five hours. Let's explore jerry more deeply –

▼ Build and features

The Jerry series of speakers are built to enjoy music at home or on the go. The compact wireless speaker has a unique design. Made of solid plastic, it looks like a cute robot wearing a headphone. At the back, it holds an on/off button, TF card port, volume rocker, USB, 3.5 mm jack, and a MicroUSB port for different connectivity options. Having Bluetooth wireless connectivity, the speaker 5W speaker also has in-built FM radio, 100Hz to 20 kHz frequency response. It has a Scrolling button to adjust the volume and manage the music. Packed with a powerful 1200 mAh battery that claimed to offer 4 to 5 hours of juice.

▼ Performance

It is a portable lightweight wireless speaker, that can be carried easily anywhere. We enjoyed listening to numerous genres of music on it. To test its capability, we used the device for a month, the focus tracks for the review were Greece 2000 (System Nipel vs. Cosmic Tone RMX) by Three Drives and Streets of Philadelphia by Bruce Springsteen. The sound signature of this speaker is good with a decent balance of bass. The sound is sharp and we felt that it is



Overall: 9/10

SCORE

PRICE: 9/10

PERFORMANCE: 8/10

FEATURES: 9/10

KEY SPECS

5 W Power Output (RMS); 1200 mAh Battery; Bluetooth V5.0; Memory Card Slot; 3.5mm Aux cable, and USB cable

PROS:

Decent sound, design, battery life, multiple connectivities

CONS:

Distortion at high volume

aggressive. This can be felt particularly clearly in the first loop of the track. Moving on to Streets of Philadelphia, the initial thump at the beginning of the track is powerful and clear. Thanks to the large drivers, the soundstage is incredible for a compact speaker.

If you switch to lossless FLAC audio files then the difference in audio quality is immediately noticeable. The same audio tracks will sound richer, and you will notice additional detail and a wider dynamic range. We were satisfied with the overall sound reproduction but there was a lack of warmth.

▼ Battery

What Vingajoy claims that the speaker delivers. The powerful 1200 mAh battery offers 5+ hours of juice. When we tested the speaker of the audio loop, playing various genres of songs on full volume, it was able to deliver 3 hours and 46 minutes of playback in one single charge. ■

Bottomline: With the overall satisfactory sound and amazing battery life, this compact speaker is a good choice at an affordable cost.

PTRON TANGENT JADE NECKBAND

Price: ₹ 1,099

To enhance your gameplay, you must have gaming headphones which is somehow a bit bulky. pTron with its Tangent Jade wireless neckband targeted the gamers. This is lightweight ENC neckband, but is it useful for gamers, let's find out –

▼ Build and features

The gaming wireless headphones come with 30ms ultra-low latency, Environmental Noise Cancellation (ENC) HD mic for a crystal clear calling experience and 10mm dynamic drivers. It is equipped with pTron's AptSense technology to deliver an immersive gaming experience. The neckband has dual-mode – Music and Gaming, which can be enabled by pressing MFB (multi-function button) 3 times quickly, however Music mode is active by default. Having a similar fashion neckband design, pTron Jade is built keeping gaming in mind. It has various RGB lights on earbuds and neckband that flashes different colors, delivering an edgy 'gamer-vibe'. It comes with large, tactile buttons to control the volume (single press) and playback (long-press), which are easy to reach and use. The neckband is IPX4 water resistance and has a flap to cover the USB-C port for complete peace of mind. It is powered by a 200 mAh battery, Bluetooth 5.2, Quick Pairing, Auto-Reconnect with Last Paired Device; Dual device pairing, etc.

▼ Performance

pTron Tangent Jade does come with a unique design comprising 10 mm drivers. The large drivers have a slightly bass-heavy signature. You can enjoy a different genre of music with clear audio and bass. However, for music enthusiasts, it can disappoint being flat and lacking at depth of music, especially with multiple layers of songs. Though nothing is outstanding yet the microphone is really good in both games and phone calls. The

**NECKBAND****Overall:****8/10**

SCORE

PRICE: **8/10**PERFORMANCE: **7/10**FEATURES: **8/10**

KEY SPECS

10mm dynamic drivers 30ms Ultra-Low latency Environmental Noise Cancellation (ENC) HD mic Music/Gaming Modes Bluetooth 5.2 200 mAh battery

PROS:

Decent sound, comfortable, bass-heavy signature, 30ms latency

CONS:

Weak magnets, non-controllable RGB lights

wireless connectivity is solid and reliable, once connected to your device it easily pairs up when you turn on the device. The company claims 30ms latency which is low enough to give you a smooth experience without any sound delays. It is easy to wear and comfortable enough to keep it on for longer hours. The earbuds have magnets but are not strong enough, when leaving them hanging on your neck they won't pair stick to each other. You need to bring them close to each other manually. Also, there is no point in having a weak magnetic neckband when they won't turn it on or off.

▼ Battery

The Jade is packed with a powerful battery that claimed to offer 25 hours of juice on one charge. While moderately using the band, it was able to deliver more than 20 hours of juice. I think if pTron had included a button or option to turn off the RGB, it might end up delivering better results. In our audio loop test, playing a different genre of song on full volume, it was able to deliver 90 mins of little low battery backup. ■

Bottomline: The pTron Tangent Jade is available at an affordable price and offers a unique design, decent sound quality and battery life. With solid connectivity and good microphone, this comfortable to use neckband is a good choice for gamers on a budget.

UBON
CL-3880 WIRELESS
NECKBAND

Price: ₹ 3,599

Ubon has introduced a new neckband with the claim to offer up to 50 hours of playtime on a single charge. The Rock Series of neckband CL – 3880 produces exhilarating HD audio quality plus it supports TF Card.

▼ Build and features

The Wireless Neckband is light-weight, comfortable fit and sporty design neckband is an ideal workout companion, as consumers would not have to worry about tangling wires or dropping earbuds. The magnetic power of this neckband builds better support in all circumstances, avoiding the product from any further damage. It also provides passive isolation as it successfully eliminates ambient noises along with a built-in-mic facility for call connectivity. While listening to music, consumers will be able to experience real music. It will allow users to enjoy richer and more dynamic music without any disturbance. The ergonomically-friendly UBON CL – 3880 Wireless Neckband features Bluetooth v5.0 and is compatible with both Android and iOS devices. For charging it has a Type-C port.

The earbuds come with a 'magnetic instant connection' feature that turns the earphones on when you separate the magnetic earbuds. Separating the earbuds also turns on pairing automatically and if the earbuds are already paired with a device, this action will pair them automatically.

▼ Performance

We tested the Ubon neckband for around a month, the focus tracks for the review were Greece 2000 (System Nipel vs. Cosmic Tone RMX) by Three Drives and Streets of Philadelphia by Bruce Springsteen. The sound signature of this neckband is impressive. The



NECKBAND

Overall: 10/10

SCORE

PRICE: 9/10

PERFORMANCE: 10/10

FEATURES: 10/10

KEY SPECS

500 mAh battery USB Type-C Bluetooth v5.0

PROS:

Comfortable, excellent bass, amazing battery life, quick connect

CONS:

A bit pricey

sound is sharp and we felt that it is aggressive. This can be felt particularly clearly in the first loop of the track.

Moving on to Streets of Philadelphia, the initial thump in the beginning of the track is powerful and clear. Thanks to the large drivers, the soundstage is incredible for a headset of this size.

If you switch to lossless FLAC audio files then the difference in audio quality is immediately noticeable. The same audio tracks will sound richer and you will notice additional detail and a wider dynamic range. We were pretty satisfied with the overall sound reproduction but there was a lack of warmth.

▼ Battery

With moderate usage, I was able to enjoy the calls and music for around two weeks on a single charge. With heavy usage, the battery lasted for around 7 to 8 days. In our audio loop test it was great with above 40 hours of playback. ■

Bottomline: If you are looking for a neckband with longer battery life and amazing sound, then UBON CL-3880 is a perfect choice. However, it's available at a little higher price point.

SMARTWATCH

FOXIN

FOXFIT PRIME
SMARTWATCH

Price: ₹ 2,899



C OVID-19 has impacted all of us and one positive change which I can observe is – that now people are serious about their health and fitness. Consumers are considering fitness bands and smartwatches to track their fitness goals. Keeping that in mind numerous brands have introduced different wrist gears, Foxin announced its new smartwatch FoxFit Prime, with plenty of interesting features to monitor health and fitness.

▼ Build and features

FoxFit Prime features an all-metallic case with a 1.3-inch (33mm) IPS display with a round dial that sports a complete capacitive and responsive touch interface for effortless control. The health monitoring feature in the watch helps you keep track of heartbeat rate and blood oxygen levels while the daily activity tracker helps in keeping track of daily steps taken, calories burnt and distances covered. The watch comes loaded with a 200mAh battery that offers up to 15 days of battery life.

The smartwatch lets you can customise your watch face with multiple watch faces to choose from. Additionally, the IP68 dust, splash and sweat resistance make it your perfect fitness companion. It also comes with call and notification feature; a user can get call, text, calendar and smartphone app notifications when their phone is nearby and connected. You can also reject calls from your smartwatch. The smartwatch is compatible with both iOS and Android devices.

▼ Performance

The FoxFit Prime Smartwatch's 1.3-inch screen produces rich colours and crisp texts. It has a decent brightness level that makes it usable even in direct sunlight. The screen has an intuitive

Overall:

9/10

SCORE

PRICE: 9/10

PERFORMANCE: 9/10

FEATURES: 9/10

KEY SPECS

Chipset - REALTEK RTL8762CK; LCD - 1.28-inch, 240*240px; Water-proof - IP68; Bluetooth 5.0; HeartRate Sensor - LC11; Blood pressure; Blood oxygen; Sleep monitor; Pedometer sensor - SC7A20; Battery 200mAh

PROS:

Numerous sports modes, solid build metal case, dedicated sensors, accurate tracking, Battery life, IP68 rating

CONS:

None

UI enabling you to scroll to all the features and keep track of your daily fitness goals and work messages.

Foxin FoxFit Prime has dedicated sensors that lead to accurate readings of real-time heart rate, SpO2 level, Blood pressure, etc. I used the device for more than 20 days. The watch delivers quite accurate results. It accurately measures steps, distance and calories burnt, useful to track your health and achieve your daily goals. You can track SpO2 (Oxygen) levels, monitor your sleep and various sports modes including running, walking, cycling, swimming, badminton, Also, using the smartwatch you can click selfies, decline calls, and control the music.

▼ Battery

The FoxFit Prime smartwatch is backed by a 200 mAh battery which is amazing and offers more than 10 days of backup with moderate usage. While utilising this at its peak, it was able to manage for 7 days. ■

Bottomline: Numerous sports modes, solid build metal case, dedicated sensors, accurate tracking, Battery life, IP68 rating

FLEXNEST

FLEXBIKE BLUETOOTH-ENABLED SMART BIKE

Price: ₹ 29,999

The fitness technology start-up Flexnest recently announced FlexBike. The Bluetooth enabled smart bike is developed keeping the modern fitness freaks. You can connect your smartphone or tablet with the bike using the FlexNest app and track your activities, plus there are videos and live trainers available for your help to achieve your fitness goals.

▼ Build and features

The FlexBike looks like any other exercise bike, but there are numerous differences. The bike creates magnetic resistance, you can customise it as per your trainer's suggestions or fitness requirements. It is a silent bike, you hardly notice any sound, the entire bike is made of metal with options to increase or decrease the seat and handle height.

The Flexnest app opens the door for various fitness opportunities. You can connect your smartphone/tablet to get access to choose from three types of bike workouts: Quick ride, Virtual ride, and Class ride. While a Quick ride is the usual workout mode, a Virtual ride brings on your phone or tablet's screen videos from various cities around the world.

Using the app you can stream On-Demand classes to your bike from the Best Instructors from around the world. It has a vast library of On-Demand Classes. There are 100+ Scenic Rides, meaning you can travel virtually to hundreds of exotic destinations from Italy to New York to Thailand. You can also compete with other riders connected from across the globe through the Flex Leaderboard.

▼ Performance

The FlexBike has no complex system to assemble or disassemble, using a small tool that comes with the bike you can easily set it up

Bottomline: The solid build, no-noise exercise bike has multiple smart features that help you to not only set up and achieve your goals. Also with the free access to Flexnest classes you can get expert advice for better overall fitness.

FITNESS SMART BIKE**Overall: 9/10**

SCORE

PRICE: 8/10
PERFORMANCE: 9/10
FEATURES: 9/10

KEY SPECS

Trainer-Led Workouts; Bluetooth Enabled; Free 1-Year Flexnest Membership; 100+ Virtual Rides; Magnetic resistance

PROS:

Solid build; No noise; Multiple adjustment options; Smart app

CONS:

None

in a few minutes. It has an adjustable seat and handles that locks-up perfectly. On the handle, you get a table holder where you can mount any table or smartphone easily. The smart bike is made out of metal, which makes it a little heavy, but thanks to the attached wheel, you can move it easily from one to another places.

Moving on to Streets of Philadelphia, the initial thump in the beginning of the track is powerful and clear. Thanks to the large drivers, the soundstage is incredible for a headset of this size.

You get your weekly report in your email, plus you can check the status on the app itself. You get a 1-Year free Flexnest Membership with the bike to Flexnest classes. ■

O2 CURE CAR AIR PURIFIER

AIR PURIFIER

Price: ₹ 6,930

Pollution is hazardous for our health; air purifiers have become a right solution to combat air pollution. Majorly they are built as per home or office requirements, but what about the car? The major air pollution we face on the road, not indoors. O2 Cure developed a portable car air purifier that plugs into any USB slot, and effective against viruses including Corona.

▼ Features

The portable air purifier comes with a Hybrid of HEPA and UV LED Technologies, it eliminates the drawbacks of UV, and protects you from all kinds of pathogens. The purifier can detect up to PM 2.5 levels and remove any bad odor from the car or room.

Unlike conventional LEDs, it can be used for disinfection, purification, and deodorization of water, air, and surfaces. Capable of using functional photons (particles of light) and photocatalysts of energy that have the characteristics of disinfection or decomposition of pollutants.

It can be applied in various ways to household goods or applications for medical and diagnostic purposes. Advanced technology utilizing a variety of patents related to photocatalysts and orientation angles of light source rather than simple photocatalysts coupling.

Combination of HEPA and UV LED is a technology by RGF Environmental Group and O2 Cure, to disinfect, purify and deodorise air and surfaces. It employs UV LEDs and photocatalysts to break down viruses, bacteria and pollution. It is a highly effective technology against Coronavirus.

HEPA and UV LED Technology is proven against neutralizing Coronavirus with 99.9% sterilization in 30 Seconds.

Bottomline: O2 Cure portable car air purifier is simple to use in your car or cabin. It is effective for most of the viruses around us but you can easily notice its noise and it doesn't have any smart feature as well.

**Overall: 7/10**

SCORE

PRICE: **8/10**PERFORMANCE: **8/10**FEATURES: **6/10**

KEY SPECS

Sterilization - UV LED + HEPA (with Carbon) Power Consumption - 4.5 W CADR - 8 CMH Input Voltage - DC5V Power Cable - USB type A - 2.1 mm DC Certification - KC, CE, FCC

PROS:

Portable Effective for almost every virus outbreaks

CONS:

No smart features Noticeable noise

▼ Performance

HEPA and UV LED technology neutralizes 99% of bacteria and viruses, including COVID-19. The device uses UV light and creates hydroperoxides superoxide ions and hydroxides, eliminating most of the viruses and bacteria available in the air.

Now let's experience it in the real world, after turning on the device and keeping it running for around an hour. The first observation was – It's a silent air purifier but when you change the mode you can notice the noise. We can feel the freshness in the air, we also noticed a reduction in bad odour. We get the air purifier turned on for longer periods, and the air around us got better.

Though it's a simple to use device, we missed some of the essential smart features which we get with almost every modern air purifier. ■

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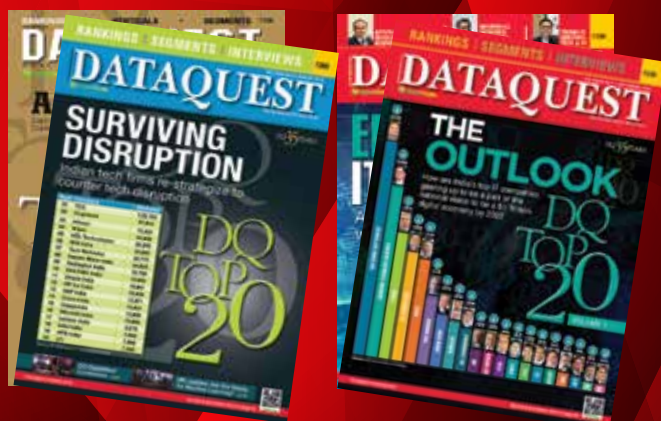
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