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EXPLORE

p10

Online Gaming Indsutry sees Big Bang Growth

EXPLORE

Sunil Rajguru
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Is 5G the next revolution for us?

In the last 25 years, a lot of telecom revolutions have kept India going forward. The landline. The PCO booth. The Internet dial-up line. The smartphone. The mobile broadband revolution. Mobile ecommerce and delivery during the pandemic. So now is 5G the next big thing for India?

The promises of 5G are huge. In theory at the maximum, it can give an Internet connection of 10Gbps. Due to its higher bandwidth, it can seamlessly connect to multiple devices: The desktop, laptop, tab and mobile. So bye bye your current broadband provider? Once the whole country is connected, you could carry it in your pocket anywhere you go.

It's great for the Internet of Things (IoTs), machine to machine interaction in Industry 4.0 and quite handy in the cloud world and it can take the Edge everywhere. Companies and institutions could have their own private networks. It could bind together the Smart Universe of: Smart Homes, Smart Factories, Smart Cars and Smart Utilities.

But it won't be that easy. We went from 2G to 3G to 4G. In a way it was seamless and all three co-exists together. (Yes, there is a small fraction of 2G users even today). But the infrastructure for 5G is something else altogether. It won't be that easy and we will have to do it in stages with city centres and commercial areas first. God knows if Tier 2/3 cities and rural areas will ever get 5G.

There are also critics who talk of an increased risk of security, spying and interference with weather satellites. In the US, airports reported some problems with 5G towers while in the UK these towers were burned down over conspiracy theories related to Covid.

In all, dozens of telecom players have been involved in the Indian story with mergers, acquisitions, exits and shutdowns making the current field quite small. The 5G auctions are seeing only 4 players: Jio, Airtel, Vodafone Idea and Adani.

Airtel is the oldest surviving telecom player which has retained its name. Vodafone Idea has survived thanks to a series of deals. Jio just a few years back shook the entire market. Adani, flush with funds, is the latest entrant. BSNL is still struggling to implement 4G all across the country. The churn will continue. One still can't imagine what the situation will be a few years after 5G is implemented.

But for the consumer, it just means that he will have a super consistent broadband connection. For the industry it will just mean more scope of innovation and a chance to offer consumers even more things.

Here's hoping that the 5G revolution takes the India Tech story to greater heights.

Sunil Rajguru

> **Promises of 5G are huge**

#PCQuestTroubleShoot

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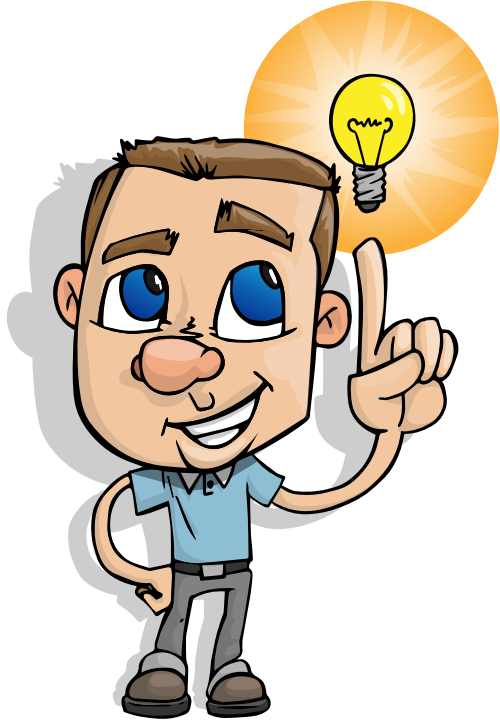
Is the MacBook Air the best choice for a laptop?

■ *Bittu Maddela*

For some, it could be the best choice but not for all. It all depends on your computing requirements. It's not always essential to spend a huge amount to get the best. Macbooks are more expensive than traditional Windows-based laptops. Plus, there are limited models available and moreover, you will be stuck to the Apple ecosystem. While if you invest the same amount, you can get a more powerful Windows based workstation or choose another configuration that suits your computing requirements for a lesser price. Moreover, you can have a world of opportunities with Windows.

What laptop configuration is needed for a computer engineering student?

■ *Ayan Guha*

Being a computer engineering student, you basically require a CPU that's optimized for all the software you will be using like emulators, IDEs, etc. You need an ample amount of memory as well to run the programs smoothly, and an HD screen as you will be working for long hours. I would recommend to get a laptop with minimum Intel Core i5 CPU that's built on Intel Evo platform to execute all your code smoothly. 16GB DDR4 RAM would be better choice for handling all multitasking and switching between software and programs efficiently. You need 1 TB SSD storage to store your data and files. A dedicated graphics performance would be able to handle tasks efficiently without any lag or stutter.

I want the best laptop under 60000, I am a student looking for the best coding and performance laptop?

■ *Naveen Kumar*

According to your budget, the best I can suggest is – Dell Inspiron 3511 (D560718Win9S). It is powered by an Intel Core i5 11th Gen CPU, 8 GB RAM, a dedicated Nvidia Mx350 (2GB) GPU and 512 GB SSD. The notebook has a 15.6-inch FHD IPS screen, enabling you to do whatever you want for long hours without straining your eyes. It is equipped with a backlight keyboard, allowing you to work in low or no light conditions. it will give you the performance you need while coding. It's light to carry around as well.

What brand of laptop is good for programming?

■ *Aradhya Pundlik*

I recommend going with Dell or HP. The company is one of the oldest in the market and has therefore not only created a brand

value for itself but also established itself well in terms of service and support network. The company has the highest market share in the PC segment in India and offers a wide range of products to choose from for every user.

For programming, you must first understand the types of programming, as each of them requires its own set of software that requires certain recommended specs. If you want to start with light programming, then you can get a good budget laptop with an Intel Core i3 processor, 8 GB DDR4 RAM and 512 GB SSD.

However, if you have a slightly heavier workload and would like a more powerful laptop, then you get a laptop that is based on the Intel Evo platformpowered by Intel Core i5 processor, 16 GB RAM, a dedicated GPU, and 1 TB SSD.

If you have an even heavier workload, like game development or programming that requires working with Big Data, then you need even better specs. Here, you can go for a mobile workstation powered by anlatest Generation Intel Core i7 processor, 32 GB RAM, 1 TB SSD, and a 4 GB graphics.

What is better for gaming: a PS4 or a laptop?

Rajarshi Ghosh

Both have their pros and cons, but in 2022, I would recommend going for a laptop over gaming console. Laptops are more portable while PS is not. The PS is only meant for gaming, while you can use the laptop for other computing purposes as well. PS comes with limited storage, which can't be upgraded while you can upgrade storage and RAM in a laptop. so if you're looking for a dedicated gaming machine, then choose a console, else choose a laptop.

Which is the best processor for a gaming laptop?

Atul Malik

The best CPU you can get is the latest 12th gen Intel Core i7 processor. But it's not only about the CPU, for a great gaming experience. You should also consider combining your laptop

with ample amount of RAM and a powerful dedicated GPU. For instance, a laptoppowered by 12th Generation Intel Core i7 processor, dedicated NVIDIA GeForce RTX 3070 Ti Laptop GPU (8 GB GDDR6) and 16 GB RAM. This laptop can handle any high-graphics game breezly.

Which laptop should I buy for gaming and design well?

Shubham Bajaj

You can use a gaming laptop for graphics design, but it's not recommended. A business laptop is developed to handle professional software and certified for tasks like graphic designing, 3D animation, etc. while gaming machines are designed for delivering good gaming performance and they also come with loud aesthetics that might not be suitable for professional use. I would say, make your choice as per your primary focus. If you are a gamer and learning graphics designing, then you can choose a gaming laptop like Dell Alienware, HP Omen. If graphics design is your primary preference, then you can check should go for business laptop like Dell Latitude or HP ProBook series of laptops.

What gaming laptop should I buy?

Puneet Dembla

I would recommend the OMEN by HP Laptop 16-b1350TX. This gaming PC is packed with a 12th Generation Intel Core i7 processor along with 16 GB RAM, 1 TB SSD, and a dedicated NVIDIA GeForce RTX 3050 (4 GB GDDR6) laptop GPU. This beast runs on the latest Windows 11. For a pleasant gaming experience, it has 16.1-inch FHD (1920 x 1080), 144 Hz, 7 ms response time, and anti-glare IPS display. Plus, it has Tempest Cooling system to keep the laptop cool even while playing the most compute intensive games. It is priced at INR 121,999. You can explore other Omen laptops depending on your budget.

Online Gaming Industry sees Big Bang Growth

Ashok Pandey
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The meteoric rise of online gaming has been seen in India in the past two years.This is going to get bigger every year. While esports evolves itself, AR, VR, NFT, and XR, metaverse gaming will be the other big trends to watch out for in 2022

Online gaming is the present and the future of entertainment. The sector is already bigger than the global movie and music industry – combined. In 2021, the Indian gaming industry generated $1.8 billion in revenue from 400 million gamers. As per a recent report by KPMG, the gaming market in India is expected to grow by 113 per cent by 2025, $5 billion and 650 million respectively. Furthermore, the demand for technology devices has gained momentum with increased use cases of creation, learning, and remote working. PCs at the center of it are being used for various tasks from content creation, and consumption, to gaming.

According to another report from YouGov Global Profiles, 25 per cent of global consumers are playing at least seven hours of video games each week on their devices – mobile and handheld. Most people play lessthan seven hours which is equivalent to a working day.

Gaming, which was once restricted to only the privileged younger generation having access to personal PCs or consoles, is now a mass favourite with no age barriers. The Indian gaming industry is driven by digitally-savvy youth, affordable smartphones, 4G connectivity and cheap data plans, and the overall technological advancement in software development and cloud technology. This has also led to mobile phones being the preferred device for gaming. While

GAURAV AGARWAL,
Co-founder, Gamezop

As digital penetration continues to grow, most digital players would want to bite into the gaming pie. Many non-gaming apps and websites have already integrated game centres comprising HTML5 games within their products. You might have seen that apps like Amazon, AccuWeather, MX Player, Paytm, and hundreds of others have a section of games. When users tap on games of their choice, they launch within these products directly – the games don't need to be installed as standalone apps.Hence, the Indian gaming sector will grow exponentially in the times ahead and digital adoption will play a major role in this evolution.

the pandemic and subsequent lockdowns accelerated the adoption of gaming, especially converting non-gamers into casual gamers, users have continued to spend time on gaming. In fact, people can not only play a variety of games from anywhere but also have an opportunity to build successful careers in this space.

The Indian gaming industry further levelled up during the pandemic-induced lockdowns amid the rising need for virtual entertainment and the popularity of eSports, which was no longer a spectator sport. The industry is now anticipated to reach about US $405 million by the end of 2022.

The rise of game streaming platforms in this space, engaging the streamers and gaming content creators from across the country on a single platform, has further aided gaming in India. Their advanced IT

infrastructure is helping the gamers collaborate to make games more real and the future of entertainment

India shipped 161 million smartphones in 2021 and had more than 800 million internet users. When smartphone gamers want to upgrade, they consider PC gaming for upgradation. Branded gaming PC category has also been witnessing strong double-digit growth overthe last few years. Hence, digital adoption is definitely helpingthe Indian gaming sector.

India is now (in 2022) home to over 433 million online gamers. It is not surprising considering the rapid surge in Internet usage we have witnessed since the

advent of 4G. Currently, the country has around 850 million internet users actively engaging with different forms of digital

Global consumers are most likely to spend 1-7 hours every week playing mobile video games

In a typical week, how much time, if at all, do you spend playing video games on your mobile phone / handheld device? (% of global consumers who play for 30 mins or more every week)

	30 minutes to 1 hour	1 to 7 hours	7 to 14 hours	14 to 21 hours	21 to 28 hours	28 to 35 hours	More than 35 hours
All	12	21	12	6	3	2	2
South Africa	17	22	11	7	4	2	3
Indonesia	16	28	13	6	3	2	2
UAE	16	22	10	5	3	2	2
India	15	19	11	6	4	2	2
Mexico	15	23	10	5	2	1	1
Malaysia	15	25	11	5	3	2	3
Saudi Arabia	14	19	11	7	3	2	2
Philippines	14	25	12	7	4	2	4
Poland	14	15	5	3	1	1	1
Hong Kong	13	26	13	7	3	2	4
Brazil	13	20	9	4	2	2	2
Italy	12	19	10	3	1	1	1

Source: YouGov Global

technologies. The growing awareness of the latest trends like AI, Cloud, analytics, AR/VR, blockchain, and others has helped Indian youth explore new avenues on Internet, and gaming is one of them.

Not just entertainment, gaming is evolving as a professional sports item thanks to the recognition eSports gained as a game in popular sports tournaments in recent years. Apart from eSports, casual games and real money games are also growing at an unprecedented level. Online gaming has become highly dynamic and is getting fiercely competitive with the launch of new games with more sophistication and complex gaming scenarios.

Moreover, the latest advancements in new-age device technologies have largely contributed to the growth of gaming in India. Today's high-end processors are designed to meet the requirements of intensive gaming. There have been significant upgrades in the display, RAM, and battery performance, which all led to an improved gaming experience. With India's smartphone user base estimated to touch 1 billion by 2026, India has the potential to emerge as the world leader in gaming.

The launch of 5G in India, and the

VISHWALOK NATH, Director, Esports Premier League & World Esports Cup

Digital adoption is the cornerstone of the Indian gaming sector as gaming requires some amount of access to the latest technology. This includes modern smartphones, access to the internet to be exposed to popular gaming titles, and esports tournaments like ESports Premier League (ESPL), and World Esports Cup (WEC). The adoption has accelerated the rise of the gaming sector by ensuring that both gamers, as well as game developers, have access to the latest innovations and technology to play and create the necessary platforms, respectively. The rapid adoption and democratization of the internet after the launch of Reliance Jio served as a major catalyst to the current boom in the sector.

penetration of high-speed internet in rural India will make online gaming more accessible across the country.More digital adoption both in terms of increased penetration of existing technologies, and creation and adoption of new digital & technological advancements like VR, metaverse, 5G, and new age platforms, would all contribute to the sector. It's a cycle that is spurred by digital adoption. Increased digital advancements lead to more gamers that leads to more audience, which leads to more brands & organisations coming up for gaming, more tournaments coming up, and investment flowing into the sector— leading to more digital adoption and advancements — this makes the sector attractive and new gamers come in. The cycle continues, and digital adoption is a silent foundation of this growth. ■

With more people discovering the fun of online gaming, avoid falling for gaming scams

Ritesh Chopra, Norton Director Sales and Field Marketing, India & SAARC Countries, NortonLifeLock

The gaming industry is attracting all genders and age groups, not just teenagers. It is crucial to stay updated and aware of the threats that can compromise your safety and privacy in this complex digital world. It's a challenging scenario and gamers can easily get into trouble, so you must be careful

The 2021 Norton Cyber Safety Insights Report: Special Release – Gaming & Cybercrime*, found that three-quarters of Indian gamers surveyed (75%) have experienced a cyberattack to their gaming account, most commonly detecting malicious software on a gaming device (35%) and detecting unauthorized access to an online gaming account (29%). Of those who experienced a cyberattack, more than 4 in 5 (81%) reported that they were financially impacted as a result and lost ₹7894 Indian rupees, on an average.

Online gaming is not all fun and games. With online gaming, come concerns including hidden fees and in-game currency, characters, or other items being lost or stolen. In the virtual field we must take precautions to protect information we share, to avoid becoming vulnerable to cyberattacks. In these challenging times, it is crucial to stay updated and aware of the threats that can compromise your safety and privacy in this complex digital world.

Here's a look at some of the more common traps cyberthieves set when trying to scam the online gamers, and measures you can take, to help:

• The Malware Problem
Whether you're gaming on a phone or PC, you could be one of the unfortunate people to click on the wrong link and download malware. Malware grants access for cybercriminals to your passwords, online bank accounts or access your credit card details. It's important to only download games from apps, legitimate sites or the original game sites.

• Fake Cheat Codes, Power Ups and Upgrades
Scammers know that gamers are often on the hunt for cheat codes to get to the next level in the game. A fake cheat code could provide scammers with yourcash, if you fall for this. I recommend gamers avoid buying cheat codes, armour upgrades or weapon boosts from an unverified source or fellow-gamer, and stick with the game's manufacturer or reputable online gaming sites.

• Phishing Scams
Watch out for click-bait email or texts targeting the details you may have registered on a streaming site, urging you to click on a link, or verify your accounts are active. These linkscould

RITESH CHOPRA, Norton Director Sales and Field Marketing, India & SAARC Countries, NortonLifeLock

be a one-way ticket to bank or credit card provider lookalike scam website, contact your bank directly if you have concerns.

• Credential Stuffing
In this type of scam, the cyberthieves use different combinations of stolen password and username combinations, which they may have bought on the dark web to target their victims. If you have any concerns that your details may have been leaked in a breach or stolen, consider updating your passwords or usea Password Manager.

As someone working in the Cyber Safety industry, I urge online gamers to take proactive steps to help safeguard gaming accounts and devices from cyberthreats. Norton 360 for Gamers offers advanced protection features for PC gamers, being specifically designed to address gamers' unique security needs. It includes a Game Optimizer[1] feature that dedicates the CPU power, the games need, by moving non-essential OS and system functions to a single core and dedicates the remaining cores to game. Help maximize game performance, for a more immersive gameplay experience.

Gamers understand the enjoyment of online gaming provides a huge source of escapism and excitement. My advice is, take the steps to avoid compromising your device security, so you can truly get ahead in the game! ▪

[1]Game Optimizer is only available on Windows (excluding Windows in S mode, Windows running on ARM processor) with 4 or more core processors.

*The 2021 Norton Cyber Safety Insights Report: Special Release – Gaming & Cybercrime was conducted by The Harris Poll on behalf of NortonLifeLock across eight countries: **https://www.nortonlifelock.com/us/en/newsroom/press-kits/2021-norton-cyber-safety-insights-report-special-release-gaming-and-cybercrime/**

ADVERTORIAL

The next big opportunities in gaming

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There are increasing investments of tech companies into gaming-specific PCs, mobiles and equipment.They are coming up with experience centres for gamers to experience these new launches. With metaverse coming into the picture the experience will get more and more real. This is just the beginning

Although the Indian eSports market stands way behind the US and China, regardless of the presence of virtual games for over a decade, we hope that it will hit the 11-billion mark by 2025. After all, a majority of Indian users discovered their appeal only during the pandemic. They are now ready to spend on eSports as much as they would on movie tickets or live soccer/cricket matches. As a result, players are increasingly taking eSports more seriously and professionally.

RAJ KUMAR RISHI, VP & MD, Consumer and Small Business, Dell Technologies, India

I believe the trend of PC gaming will continue, given how the community has expanded and the increasing awareness of gaming as a viable career option. Most importantly, India is a growth market for gaming. If you look at the number of investments and the speed with which the ecosystem has been growing, we have significant confidence in our strategy, our gaming products, our relationships, as well as our way of doing business.

The increasing viewership of eSports is also grabbing major consumer brands' attention and investment interest. Brands like Intel, HP, and Philips have already joined the bandwagon by sponsoring tournaments and professional teams.

The consumer mindset has shifted from casual games to competitive video gaming, as well as multiplayer gaming. The changing preference and extensive popularity of games like FreeFire, Dota-2, or Valorant, have found space in everyone's smartphones and gaming consoles. Today gaming and esports are much more than just forms of entertainment and hobby. It is a highly competitive industry and has opened various career options for all. Tournament awards and increasing cash prizes, increasing global and national esports competitions, and brand sponsorships, there is a lot to explore.

Gaming, like music and movies, has become an integral part of our lifestyle. As technology evolves and games become better, it's natural to expect new avenues to open up within the realm of gaming. Gaming in India will continue to grow on mobile because of their ubiquity and affordability. Smartphones are an increasing necessity and that they offer fun gaming and other entertainment options makes them a must have. It is projected that India will touch more than 70% smartphone penetration by 2023. Hence, there is a lot of room for growth in mobile gaming. Mass scale adoption of VR in India is unlikely to come in the short term, even though the true blue aficionados are swearing by it.

▼ Cloud Gaming

The next-generation gaming consoles are built keeping in consideration the rising popularity of cloud-based gaming. The cloud has made its presence felt in the gaming industry, but the integration of cloud computing with game design might not necessarily improve the look or play of games. The main reason it hasn't yet fully taken off is that the latency and the technology required to support the service is still in development. For example, while playing on a PC or console, the data processing, graphics and video rendering is completely dependent on one's internet service provider. This in turn affects the image quality or download speed, as well as the effect data caps have when using a cloud gaming service.

▼ A viable career option

Until recently, esports was primarily considered a PC trend. But the explosive popularity of gaming across platforms has triggered a surge in esports tournaments and live stream events. Today, gamers are actively participating and competing in esports events and tournaments. Also, the fact that there is a lot of industry participation and government regulations to make it more mainstream. The government bodies are also recognizing esports

as a professional sport, further expanding opportunities for gamers. Esports is no longer like a hobby or an underground kind of event, that has progressed to become a medal event in the Asian games.

The inclusion of esports as a medal event in the 19th Asian games, is a positive thing for the industry, as it will encourage the next generation to consider esports as a viable career option.Even though the industry is relatively new, there is a huge potential in terms of popularity, reach, and even in terms of earning potential. The prize money for esports is bigger than some of the mainstream sports. There is also a huge potential for women gamers to become a key part of esports. It can be gender neutral and that opens up a huge growth potential. Indian eSports market, which was confined to metros, is now expanding to tier 2 and 3 cities thanks to the broadband penetration, dominated by 4G. With 5G, we hope eSports will be a major component of the Indian gaming industry.

Games can be downloaded directly to a console, which requires higher capacities, especially with today's standard modern AAA game being at least 25Gb in size and higher, uninterrupted frame rates. That requires storage capacity expansion with high-capacity gaming HDDs, and NVMe SSDs like FireCuda 530 that's pushing the limits of a PCIe 4.0 x4 interface with a rated sequential read speed at 7300 MB/s for faster transfer rates. Video games are one of the fun aspects of our business, regardless of whether the gamers save their profiles or game data on cloud or on internal/external drives.

SAMEER BHATIA, Director of Asia Pacific Consumer Business Group, and Country Manager for India & SAARC, Seagate Technology

▼ Metaverse

Since Metaverse leverages technologies AR and VR to create a more organic experience, players feel a lifelike experience exactly how they would feel in the real world. Metaverse gaming platforms are interoperable, allowing players to move their gaming items from one space to another without any major change. In the coming years, with a better and more efficient data transformation structure, one must start replacing gaming with Meta Experiencing and not only games in it. Further to this, social, trading, business, and entertainment might start taking place in this new universe. Metaverse has the capability to help people experience gaming & entertainment like never before when clubbed with a portable & powerful device. Powerful machines with the latest technology to ensure a seamless user experience.

So, experiencing the complete beauty on your laptop with a VR headset or enjoying it on the go with your handset is the future of gaming.

Witnessing the scope of growth in the Indian eSports, blockchain gaming creators are being roped in to proliferate Web3 gaming in the industry. Meanwhile, new-age securities such as non-fungible tokens (NFTs) are also being integrated in this space. Gaming platforms can build lucrative revenue streams and drive user retention by converting virtual avatars, in-game rewards, and streaks into NFTs. As the Indian eSports sector continues to grow rapidly, there will be an increase in the frequency of virtual gaming events. This will create more jobs for game streamers, techies, designers, and game content creators, besides other job roles like data handlers, event organisers, and game commentators.

PIYUSH KUMAR, Founder & CEO, Rooter

Mainstreaming Gaming-as-a-Service

Prabhu Ram
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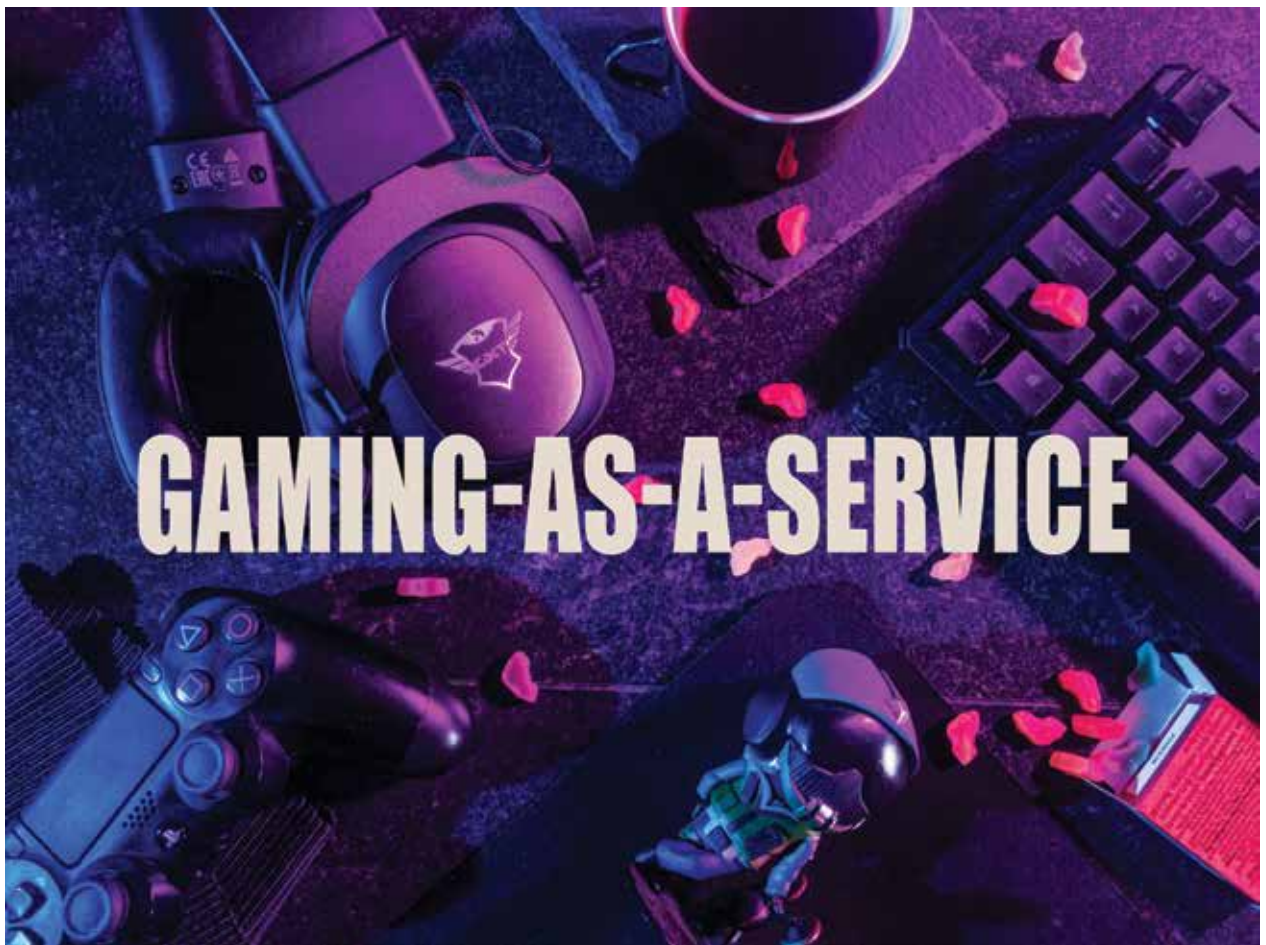
GaaS is a growing trend in the gaming industry, this model is ultimately a good thing for gamers–a real possibility in a future that includes cloud gaming and games-as-platforms. Additionally, with the rollout of 5G, GaaS will benefit from even more players coming in to challenge and push the industry forward

Through the course of the pandemic, India has seen a strong uptick in gaming. This is driven by the rise of powerful smartphones across price-tiers as well as affordable data costs.

At CyberMedia Research (CMR), the CMR Gaming Practice has been tracking the gaming industry in India, both from a supply side (devices intelligence) as well as demand side (consumer research) perspective.

Undoubtedly, over the course of the pandemic years, with more consumers spending time at home, gaminghas seen a rapid traction in India.

There are three archetypes of Indian gamers that CMR Gaming Practice has identified, based on the time spent on gaming. These include hyper-casual gamers, casual gamers and hardcore gamers.

Interestingly, 48 months after the onset of COVID19, CMR's most recent gamer survey pointed out to a 40% inflectionin hardcore gamers in India. Alongside, there has been a decline in hyper-casual gamers. Game play time has increased, with three in every five gamers spending anywhere between 31 to 120 minutes in a typical play session. On an average, each gamer spends 79 minutes in a typical play session. In comparison to the pre-pandemic phase, there has been a whopping 100% uptick in paid gaming. All of these trends point to a healthy 16% YoY growth in mobile gaming.

Recent research from CMR's Gaming Practice points to some interesting trends around hardcore gamers. Three in every five gamers play action/adventure games. Hardcore gamers mostly play, or prefer action, and first-person shooter games.

Two in every three hardcore gamers have participated in online gaming contests, with a 10% YoY growth in gamer participation. Hardcore gamers participate, on an average, in eight online gaming contests annually.

Further, four in every nine hardcore gamers have played cloud-based games on their smartphone, with cloud gaming familiarity driven by Sony PlayStation (PS Now), Microsoft Xbox Game Pass and Google Stadia.

Let us look at what the future portends for

PRABHU RAM, Head-Industry Intelligence Group, CyberMedia Research (CMR)

Cloud gaming, and gaming-as-a-service.

▾ Anytime, Anywhere: Towards Seamless Gaming Experiences

For gamers, the ability to play anytime, anywhere, without technical glitches,will be a big step forward. This is a future where gamers are able to stream and enjoy high-quality version of their games. That's the potential and promise of cloud gaming. With cloud gaming, gamers will be able to enjoy seamless gaming experiences across devices and environments. Imagine playing on one device, and leaving it, to pick-up another device and continue playing the same game without interruption. That's the power of Cloud.

With Cloud, gaming experiences will get further democratized. The need for specialized and local processing hardware also come down. Cloud gaming will ensure that powerful hardware and incredible software translates into best-in-class visuals and gaming experiences.

Lastly, it is all about instant gratification. Gamers can leverage cloud gaming and play games instantly, without having to download games.

▾ Tailoring Gaming-as-a-Service for different gamer arche types.

Until now, the gaming experience for consumers was dictated primarily by the

stability of their internet connection. As 5G-ready smartphones become more powerful, and 5G rolls-out in the near horizon, the opportunity is there to unlock the benefits of cloud gaming, enhancing the gaming experience, and enabling new value propositions for game developers to cater to different gamer archetypes.

While cloud gaming may seem inevitable in the near horizon, it will require a concentrated push spelling out its benefits to specific gamer archetypes for it to become mainstream.

Let us dive-in further on what it will take.

Take, for instance, hyper-casual gamers. They are mostly avid mobile gamers. For them, cloud gaming will enable instant gratification, ease of convenience, with no download required.

For Casual gamers, it will be a freemium mode that will appeal. This would mean ease of convenience and instant access to newer games, with enhanced streaming quality enticing them to play more.

CMR's gaming research already points to some maturity around cloud gaming amongst hardcore gamers. Cloud gaming services that offer best-in-class hardware, rich gaming content, and latency will curry favour with them.

▾ The Rise and Rise of Cloud Gaming Ecosystem

The cloud gaming ecosystem includes a few tech majors dominating the landscape. Consider, for instance, Sony. Sony has been a pioneer in cloud gaming with its PlayStation Now service. Similarly, Microsoft debuted xCloud, while Nintendo came with Switch Cloud. Nvidia came with GeForce NOW. Amazon Luna and Google Stadia are some other notable names.

Beyond these tech giants, there are new market entrants, as well as new potential alliances that seem to build on the recent spike in cloud gaming globally.

In the recent past, Netflix has been toying with the idea of launching a new game streaming offerings.

Cloud gaming is a trend that TV manufacturers are responding to. For instance, LG and Samsung are bringing cloud gaming via GeForce NOW and Stadia onto some of their latest TV models.

Microsoft, under Satya Nadella and Xbox Boss Phil Spencer, has been focused on bringing cloud gaming streaming capabilities to new device platforms, including smartphones and TVs.

Lastly, earlier this month, Netflix announced Microsoft as their 'global advertising technology and sales partner'. This news does pique my interest. While am unsure as to Microsoft's capabilities in bringing innovation to adtech, I do see some synergies in gaming. Netflix is currently struggling with subscriber and revenue growth. It is looking to diversify its bets, and scout for new revenue generation possibilities. ■

The author is Head-Industry Intelligence Group, CyberMedia Research (CMR)

The changing gaming landscape and what the future holds

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Metaverse, 5G, AR and VR are all improving user experience to a great extent. This will motivate creators in ideating more interactive and immersive content across all social media platforms

Over the years how gamers like to play games has changed. PC, mobile, video and console gaming keep on developing on account of technological leaps, such as 3D illustrations, Virtual Reality and Artificial Intelligence, as does the equipment to play them. There are different reasons for this changing landscape.One reason being the experience gamers receive from these various mediums and devices. There is also a clear upgrade path for many gamers. Many may start as mobile gamers and move to PC gaming, which requires seriousness compared to playing the game on mobile devices.

Mobile gaming has been growing rapidly and is great for entertaining consumers or passing time while traveling and consoles are great as an all-rounder solution for budget gaming while sacrificing graphics performance. Considering the lower disposable incomes of the masses across the country, most are not comfortable spending a significant amount on PCs, or even consoles every couple of years.

Console gaming is more of an upper-

As we know, the launch of gaming PCs, laptops, and consoles sparked a gaming revolution in India in the early 90s. This was later complemented by the growth of internet technologies, which helped bring online gaming to the mass. Mobile devices, especially smartphones, captured the gaming arena of the 21st century. Going forward, it's the turn of cloud gaming technologies and metaverse powered by VR. Metaverse is set to redefine online gaming in terms of both player experience and technology advancements. Leading technology firms are investing in metaverse to explore the full potential it can offer to the gaming community. However, connectivity and low latency are integral to facilitating a metaverse gaming environment. In India, we assume the metaverse-based gaming will garner momentum with 5G considering the several developments happening in the industry, especially in the adoption of Edge computing and AR/VR. Metaverse will not only help the gaming market flourish but also open new business opportunities for software providers, device vendors, game publishers, and the entire ecosystem participants.

ANKU JAIN, Managing Director, MediaTek India

class phenomenon and not all can afford the experience of console gaming. For VR and Metaverse, it is basically about the experience with physical and virtual realities merging to offer an immersive experience to the gamers. The user can literally have the experience of being inside the environment and the kind of experience you can have from the metaverse is not possible with many of the current equipment that the gamers have. Hardware and software companies are working to bring in games and hardware to be ready for the metaverse experience which will further strengthen the gaming industry.

▾ What is the future of PC gaming?

As we live differently, every gamer has his own set of priorities, though smartphones have changed a million gamers' minds, yet gaming PCs are still there with the league of gamers. Metaverse is going to impact the gaming industry surely with many positive effects, but what about gaming PCs?Let's explore what industry experts have to say –

Sooraj Balakrishnan, Head of Marketing, Acer India

I don't believe that smartphones and metaverse will end gaming on PC. Yes, I think the future of gaming is AR & VR, and Metaverse is leveraging these technologies to create a more organic experience. The gaming experience here is more lifelike allowing the gamers to feel like the real world. Technological advancement has made it possible for gamers to experience this.

I feel mobile gaming is like an entry point of gaming and not a replacement to PC gaming. As more and more mobile gamers come into the fore it is good for PC gaming because the portion of the audience would want to take up gaming more seriously and for them, PC is the best option. There is a transition from mobile to laptop gaming that is happening currently. Many gamers like the

immersive experience that PC gaming offers. In PC gaming, the technology and games are more advanced. Also, for metaverse as well, you will need the power of PC to render such intense virtual worlds. So, it's not easy to render such graphically rich virtual worlds without the power of a PC.

All these new technologies will only add to the appeal of PC gaming rather than killing it.

Bharath Shenoy, Principal Analyst – Personal Computing Devices, IDC India

All the gaming ecosystems will co-exist though the concentration might be more on smartphone gaming. Professional gamers are more inclined to pc gaming and consoles. Metaverse probably would open newer windows of possibilities and might give a different dimension to gaming. However, it is early days for metaverse and it will take time for the ecosystem to take shape and mature. With gamers most likely to share a big amount of personal information for a personalized immersive experience, data security becomes extremely critical. Till the confidence level on data security increases substantially, there would be some concerns around metaverse gaming.

Green Lin, Regional Marketing Manager, MSI

PC gaming is here to stay as the kind of viewing experience one gets while playing on a PC cannot be compared to the likes of a mobile phone. In fact, recent reports suggest that a chunk of mobile gamers say that they want to shift to PC gaming. The preference for moving to PCs for gaming is led by millennials and Gen Z, followed by Casual and Enthusiast Gamers. While mobile

gaming gives the convenience of being casual and portable, PC gaming offers better game titles and graphics. In the end, it comes down to one's choices and way of life.

Arijeet Talapatra, CEO, TECNO Mobile India

Metaverse is gaining enormous popularity due to its in-depth engagement and novelty factor. Furthermore, in the last few years, the mobile gaming market has seen massive growth. More people are adopting video games and e-sports in their recreational routine, especially post Covid outbreak due to physical limitations. Taking the same into consideration, a lot of smartphone manufacturers have started investing in the same space. Many of the phones that are being manufactured now are aligned with the needs of Indian gamers. These include smartphones with the focus on offering better battery life, and performance-oriented processors which can go on without interruptions.

Gaurav Agarwal, Co-founder, Gamezop

The main advantage of gaming on the smartphone over PC is mobility. It can be played anytime and anywhere and has given rise to a new generation of mobile-first gamers. Game developers are also designing more high-end games for mobiles to rival the quality of PC games.

Having said that, the PC still offers a more premium gaming experience. The enhanced interface and accessories one can use to play make games more immersive. So, PC games may not be as largely played as smartphone games, but there is still definitely a market for them. Another appeal of PC gaming is the close-knit community it fosters through Twitch and Discord.

Mobile or PC, both provide opportunities and platforms for game developers to reach more gamers. So it is safe to say that PC gaming is not going anywhere anytime soon.

Vishwalok Nath, Director, Esports Premier League & World Esports Cup

PC gaming will continue to have a place in the market for years to come due to the versatility they offer. However, one should watch out for the transformation of the PC as things move towards ARM, and/or hand-held portable form factors. Smartphones will continue to grow and dominate the space but there will always be limitations in the fidelity they would offer when compared to a full-fledged PC. Talking about the metaverse, we are a long way from the general adoption of this technology in India.

Animesh Agarwal, Founder and CEO of 8bit Creatives

According to a survey released by HP last year, 37% of mobile gamers want to shift to PC. The HP India gaming landscape report 2021, also found that 89% of respondents believed that a PC offers them a better gaming experience than any smartphone.

Top brands like Dell, Lenovo, Samsung, HP are constantly upgrading their model specifications to satisfy this consumer category. Features like high-quality graphic cards, speed of the processor, battery life, immersive display feature, better thermal innovation, and huge storage capacity are some of the core specifications gamers are looking for in their PCs. With metaverse games easily accessible on PCs, I believe they will go a long way. ∎

The Top Gaming Devices

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AR/VR adoption is gaining traction in gaming. Metaverse promises a high level of personalised and immersive experience in gaming. Hence, its most likely metaverse would start focusing more on gaming, primarily smartphone gaming due to its high user base

Metaverse is simply a virtual world that will make interactions over the web more realistic, and as such is still in its very early stages of development. One could say that gaming may actually have a first mover advantage over other industries when it comes to the metaverse.

Metaverse game developers are extensively applying new-age technologies such as AR, VR, blockchain and AI, to give a more futuristic experience. Today people are influenced by technological advancement and want to get first-hand experience with the latest development. Today Mobile gaming is offering top-notch VR experiences and allowing 3D illustration users to closely connect with their acquaintances as digital avatars. Metaverse offers a rich gaming experience, making it more immersive which has resulted in its huge success.

And the growth seems never to stop. Manufacturers like Nintendo, Microsoft and Sony, etc. have the finest gaming consoles. The next-generation gaming devices will enable you to enjoy the latest and greatest games with the highest quality.

▼ Gaming Laptop/Console

▼ Acer Predator Helios 300

The Acer Predator Helios 300 SpatialLabs Edition (PH315-55s) is a powerful gaming laptop that enables glasses-free, stereoscopic 3D gaming experiences. With the SpatialLabsTrueGame application, gamers can effortlessly play supported games in a 3D mode on the device, where details of the scene are brought to life. Rooms appear more spacious, objects appear genuinely layered, and adventures become more thrilling—all smooth, in real-time, and without the need for special glasses.

▼ Dell Alienware x15 R2 Gaming Laptop

The laptop is built to deliver elite performance across your favorite games and applications. Packed with AI NVIDIA DLSS, designed to increase performance, without sacrificing quality, by using cutting-edge AI. More Immersive Experiences Ray Tracing enables realistic and immersive graphics, which run fast thanks to 2nd gen RT Cores. Optimized Power and Performance NVIDIA Max-Q is a suite of technologies powered by AI that optimize laptops to deliver high performance in thin form factors.

▼ HP OMEN 17

HP India recently unveiled the OMEN 17, which offers gamers an exclusive edge-to-edge immersion in the latest high-definition games on its 17.3-inch screen from anywhere. Designed for professional and mainstream gamers, the attention-grabbing feature in this device is its cooling effect. It is equipped with the OMEN tempest cooling technology, with 3-sided venting and 5-way airflow, that keeps the laptop cool ensuring an excellent gaming experience.

▼ MSI Gaming Stealth GS66

It is a gaming beast but doesn't get confused with its look. Measuring just 1.16 inches thick and weighing 4.19 pounds, this laptop will let you take up to an Nvidia RTX 3070Ti on the road, without blowing your back out. It also helps that it's gorgeous: an all-black design with gold accents and RGB lighting.The meta-ready laptop is packed with Intel 12thGen i9-12900H CPU and the world's thinnest 0.1 mm sharp-edged fan blade design, the Cooler Boost Trinity+ enhances the fan airflow and provides the best gaming experience.

▼ Lenovo Legion 5i Pro Gen 6

The gaming laptop is engineered to deliver devastation in and out of the arena. The 2022 version of the Legion 5 Pro brings more of the same but delivers one of the best experiences. As for what's new, it's faster, with support for the latest 12th Gen Intel processors and AMD's Ryzen 6000 H-series processors, along with new and more powerful GPUs. Also, last year's edgier-looking top shell looks a little more

toned down now.

▼ Gaming Consoles

▼ PlayStation 5

Sony's next-gen PlayStation is simpler to setup and has a new well-thought-out user interface. It comes with the revolutionary DualSense controller and added bonuses for PS Plus members. Like its predecessor, the latest PlayStation is also capable of VR gaming. Sony also has finally brought backwards compatibility into the fold, too, and the PS5 will be able to play most PS4 games, so you won't miss out on late-gen titles like The Last of Us Part II and Ghosts of Tsushima.

▼ Xbox Series X

The latest Xbox console is super-fast, surprisingly quiet, and delivers amazing gaming performance, ensuring that games old and new look and perform better than ever before. It can deliver stunning 4K gameplay with a high frame rate, which makes your graphics spectacular. Plus, it has 8K HDR and exceptional cloud gaming capabilities. The console also has a 4K Blu-Ray drive and the ability to deliver high-resolution content from popular streaming services.

▼ Nintendo Switch OLED

It's a pleasing upgrade to the standard

Switch with a seven-inch OLED screen. The latest Switch is a versatile gaming console that can transform from a mobile gaming rig to a home gaming console by docking it into a station. The console can be played on your home TV and taken on the go. The new Switch has excellent controllers and a constantly growing library of fun games with iconic characters. The new model's tabletop stand has improved, too.

▼ VR Headsets

▼ Oculus Quest 2/Meta Quest 2

The Oculus Quest 2 (or Meta Quest 2) is an inexpensive VR headset for gamers. You don't need any additional hardware, and you don't have to deal with cables as well. Powered by Qualcomm Snapdragon 865 chipset, the VR headset comes with two controllers to play any VR game smoothly.

▼ Sony PlayStation VR

If you have a PS4 or PS5, the PlayStation VR is the perfect VR gear for you. It still uses motion

controllers that date back to 2010, but it's worth considering for your PS VR games. It doesn't require additional hardware to play a breathing game. The world comes alive all around you, with a seamless field of view wherever you turn.

▼ HTC Vive Pro 2

One of the most advanced VR headsets perfect for both enthusiasts and professionals. It delivers the sharpest picture at 2,448 by 2,448 pixels resolution per eye. It works with SteamVR and has its own VR software store in the form of Viveport. If you want the best VR experience available without diving into pro-level extremes, the Vive Pro 2 combined with Valve Index controllers is the combination to go with.

▼ HP Reverb G2

Compared to Oculus Quest 2, HP Reverb G2 is an expensive VR device but if you want to try PC-tethered VR gaming without spending a

ton of money, it's perfect for you. It also uses camera-based tracking, so you don't need to set up base stations as you do with the Vive Pro 2. ■

VR Games	Platform
Zenith: The Last City	Quest, PSVR, PC VR
Unplugged	Quest
Until You Fall	PC VR, PSVR, Quest
A Fisherman's Tale	PC VR, PSVR, Quest
Resident Evil 7: Biohazard	PSVR
Blood & Truth	PSVR
Ultrawings 2	Quest 2, PC VR to follow
Eleven: Table Tennis	PC VR, Quest
Beat Saber	PC VR, PSVR, Quest
A Township Tale VR	PC VR, Quest
Wipeout: The Omega Collection	PSVR
Skyrim VR	PC VR, PSVR
Blade And Sorcery	PC VR, Quest 2
Half-Life: Alyx	PC VR
The Walking Dead: Saints & Sinners	PC VR, PSVR, Quest
Astro Bot Rescue Mission	PSVR
Superhot VR	PC VR, PSVR, Quest
Demeo	Quest, PC VR
Pistol Whip	PC VR, PSVR, Quest
Boneworks	PC VR

eSports Games	Genre
Counter-Strike: Global Offensive	First-person shooter
Fortnite	Battle Royale
Dota 2	Multiplayer Online Battle Arena (MOBA)
Overwatch	First-person shooter
Apex Legends	Battle Royale
Dragon Ball FighterZ	Action/Fighting
The King of Fighters XIV	Fighting
League of legends	Multiplayer Online Battle Arena (MOBA)
Mortal Kombat 11	Action/Fighting
Rocket League	Sports
Samurai Shodown	Action/Fighting
StarCraft II: Legacy of the Void	Real-time strategy
Street Fighter V: Champion Edition	Action/Fighting
Super Smash Bros. Ultimate	Action/Fighting
Tekken 7	Action/Fighting

17TH EDITION
DATAQUEST
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EMPLOYABILITY INDEX
RANKING OF
100 ENGINEERING
COLLEGES

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Insights powered by research

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How AI can make us superhuman

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Richard Potter, CEO, Peak, talks about Artificial Intelligence in the post-pandemic world and how it can make us superhuman. He highlights the importance of data and looks at the industries that are benefiting from all of this. Edited excerpts from a video interview…

▼ Changes taking place in the post-pandemic era…

Because AI is such a horizontal technology, I almost view it in a sense as a data technology. The only thing that makes AI work is data. We can use that in different ways. I think the next frontier for AI in business is getting into the nuts and bolts of how companies run themselves and we see the businesses as the output of the sum total of all of their decisions. That's where we are trying to enable companies to enhance that decision making, using the predictive and categorical capabilities of algorithms and AI.

The last couple of years have seen an acceleration in technology adoption largely driven by the pandemic because lots of things moved online and people started working remotely. A lot more of our lives are digital and we are creating a lot of data. We are able to understand our businesses better because of that data. We can use that understanding to create AI and decision intelligence applications to help run our businesses better.

▼ Data and the role of AI-ML…

Just having a mobile phone in itself produces a huge amount of data constantly: Event based data, logs of all the actions that you take, every movement of interactions with applications and things like that. That quantity of data requires technologies to help people process it and draw meaning from it. That's where you see Machine Learning often used to extract insight from those huge data sets.

For Peak we focus a lot more on the practical application of data and AI in the enterprise for what we would call those decisions that make up the value chain of companies. It tends not necessarily to be processing that type of data for what Peak does and that draws the link to how we can make workers and businesses in their day jobs become superhumans. It's simply taking the data that we use every day to make our decisions anyway. Let's take an obvious example.

Imagine we are a retailer selling clothes. We've got physical and digital stores. I need to decide where to put my products. I need to think about what the demand for my product would be. How fast is it going to sell? What

RICHARD POTTER, CEO, Peak

should I price it at? What amount of shelf space should it take? All of these will impact my business numbers: sales, profit margins and capital efficiency.

As humans we are good at making those decisions. We take a lot of data intuitively through our experience and we can use that data to make forecast decisions. We can understand demand, we can set price points and have a feel for how much someone might pay for a product. But in today's world those decisions are increasingly complicated because as we have in the case of retail, there are lots of different ways I can sell my products, lots of different ways people can find my product and lots of different ways that I can fulfil the demand for that product.

▼ Making us superhuman…

Where decision intelligence and AI can help you become superhuman in that case is processing those transactional data sets, understanding the consumer behaviour and giving us precise real time views of what demand and price sensitivity is going to be and with that optimizing, say product

allocation and pricing.

The fascinating thing for me is the interaction between the human and machine changes a little bit in this world. We are moving away from a world where, in this case, a merchandiser and a retail company would work with a spreadsheet to figure it out and then distribute those products and price them all. We'll take suggestions from the machine as to what the optimal allocation of those products and pricing would be and approve them.

What it means, and why I say superhuman, is that we can now do those tasks continuously in real time if we want to, across the entire product range. We can optimize the entire decision set for growth and revenue, or profit or customer service, making sure we never stock out of an important product. We can set those goals and the AI can help us achieve them. We become even better at doing our jobs.

I would categorize it in two different ways. As to the data explosion, we need technologies to help us compute and understand that data and what it's telling us. That's beyond human cognition. But the practical applications of AI, these are things we do every day as businesspeople or users in our jobs.

▼ The next frontier…

This technology is amplifying our ability to do that even better. That I think is the next frontier. That's the thing that we are seeing with our customer base, getting these meaningful gains in performance because business teams can make these consistently great highly optimized decision sets.

Imagination, creativity, and that real intuition is what people want to do. That all comes from us as humans. We are talking about technology that helps us process things and take way all those things that we don't want to do. Gathering data and getting in a place to make a decision: Here's a machine

that's going to help me optimize my decisions all the time and be great at my job. End users love our products for that reason.

▼ Industries benefiting from AI…

Looking at it through Peak's worldview, what we see is that AI is very well suited to those companies that have a relatively high frequency of transactional data. It could be like a transaction like you sold a product or an event-based things like a product movement, logistics etc.

You saw online retailers adopt these technologies earlier than physical world companies because the data sets are more structured, easier to gather, and they produce more data because of their nature of being digital businesses. Prior to that you saw AI-ML used a lot in financial services and the reason for that is high frequency transaction businesses.

You need that data velocity and quantity to train the algorithms to build these applications in the first place. Those are the sorts of industries that benefited. And digital native companies like Google and Facebook. They are just huge data companies.

(Catch the complete video interview at the PCQuest YouTube Channel)

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Why espousing AI and ML-integrated marketing is crucial for elevating customer experience

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Personalization has taken over the reins in redefining marketing. What better than understanding the customer preference and providing precise products/ services catering to their needs. Let's understand the powerplay of Machine Learning and AI in the current times

I n modern-day personalization has attained the peak position in driving success for any business' marketed product or service. The machinery of traditional media started fading about a decade ago as more smartphones started making inroads in the market with cost-effective internet services and all that on the backdrop of the rising disposable income of individuals in India. Cash intensive and lacking a results-oriented approach has led the traditional marketing technique to take the back seat. Driven by the demographic approach, predominantly through traditional marketing techniques, typically physical, businesses were only able to influence a particular consumer base where they sought their flyers to be distributed, billboards to be placed, or Radio Ads running on a particular local radio channel.

But with the advent of the internet, a new world of marketing opened. This has been on the back of the widespread penetration of digital media. It has empowered the consumer to select from a wide range of choices of anything that they want to avail of, be it the type of shirt that perfectly fits them based on their previous search or hailing their favorite SUV on lease from a self-drive car aggregator for their upcoming staycation. This personalization has not arrived out of the blue but is backed by timeless pieces of data. This data is nothing but a repository of the past preferences of customers and predicts their future behavior in availing of a product or service.

Hence, in the current times, a business' key focus while ideating a marketing campaign is to collect essential relevant data about the consumers that they are eyeing to tap. This solves a majority of the hurdle, as a consumer usually makes a decision while considering various aspects kept in mind. This is good from the perspective of understanding the consumer and predicting their approach to a product. But each consumer has had a totally contrasting experience in their life to date and their perspective might be totally different in seeing the product. So, does that mean that you would prefer the first consumer over the second? No. They both are crucial leads

ARIF KAZI, Managing Director and Founder, Dust Value

for a business to bring in cash flow. Also, they are just two people that we cited, but you have hundreds of thousands of people whom you want to tap who have had different experiences and have a unique consumerism pattern. Does that mean, your one-size-fits-all marketing approach is going to engage them into making them your consumer and in turn brand ambassadors? No. Personalization is the answer.

This is where the new age of marketing comes into play. Machine Learning and Artificial Intelligence (AI) have come a long way in enhancing operations of all the traditional practices that to date remain the building blocks of commerce. Be it Production, Sales, Marketing, Feedback, etc., these technologies have put forth prudent application that has enhanced the functionality of several businesses. Let's dive deeper into knowing the application of AI and Machine Learning in marketing and how it enhances the consumer experience.

Now comes the question of how do you target each individual from the enormous database with an approach that only influences him in deciding to make a move and buying a product or service while believing that the transaction will benefit as per their understanding? Here's where

Machine Learning pitches in.

For example, say you shop for a particular size of a shirt of a particular brand in a particular pattern and often in select shades of color from a website/ fashion app that you are a member of. Say one day you search for new designs of shirts but don't find anything suiting up to your expectations. In a couple of hours, do you receive a notification of the app reading a message like, "(Your name), Were you finding a pink shirt from United Colours on Benetton? We're sorry they ran out of stock but here are some similar shirts in which you will look as stunning!" You might want to check out them, so you give in and click on the notification and may even end up buying an alternative. What you did in turn was, you keyed in several keywords in the search tab of the app while searching for your preferred shirts. Like, Pink shirts, United Colours of Benetton, etc. What the app did was record and learn about your preference through AI. It then filtered and surfaced only related products from various brands basis your other search preferences. This is how Artificial Intelligence made it simpler for the online apparel store for marketing while providing you as a consumer with a personalized experience.

A classic example of machine learning too can be mentioned using the same online apparel app. Say you bought a pair of trousers of size 34 from a popular brand like Raymond through this online fashion marketplace app about a year ago. Now, if you search for similar shade trousers and like one of the many listed ones, however, it is not from Raymond, but its sister brand Parx. Say you select size 34 again, but you know that each brand, even though from the same company, many have different criteria for fittings. In this case, as you select the size 34, it will suggest you with a statement below, "According to your previous purchase, size 32 will be the perfect fit for you from Parx." What happened here was it learned about your preference from the past and kept it recorded and the AI on the back end prompted you about the variation in size of apparel between two brands of the same company that might fit you ideally. This makes your buying experience seamless too and hence willing more to rely on the recommended size on the app moving forward while shopping without being conscious about the sizing/ fitting.

That is just citing an example of the application of Machine Learning and Artificial Intelligence in one instance. There are hundreds and thousands of permutations and combinations where AI and Machine learning can be plugged into marketing to elevate customer experience on the back of personalizing it at every touchpoint. ■

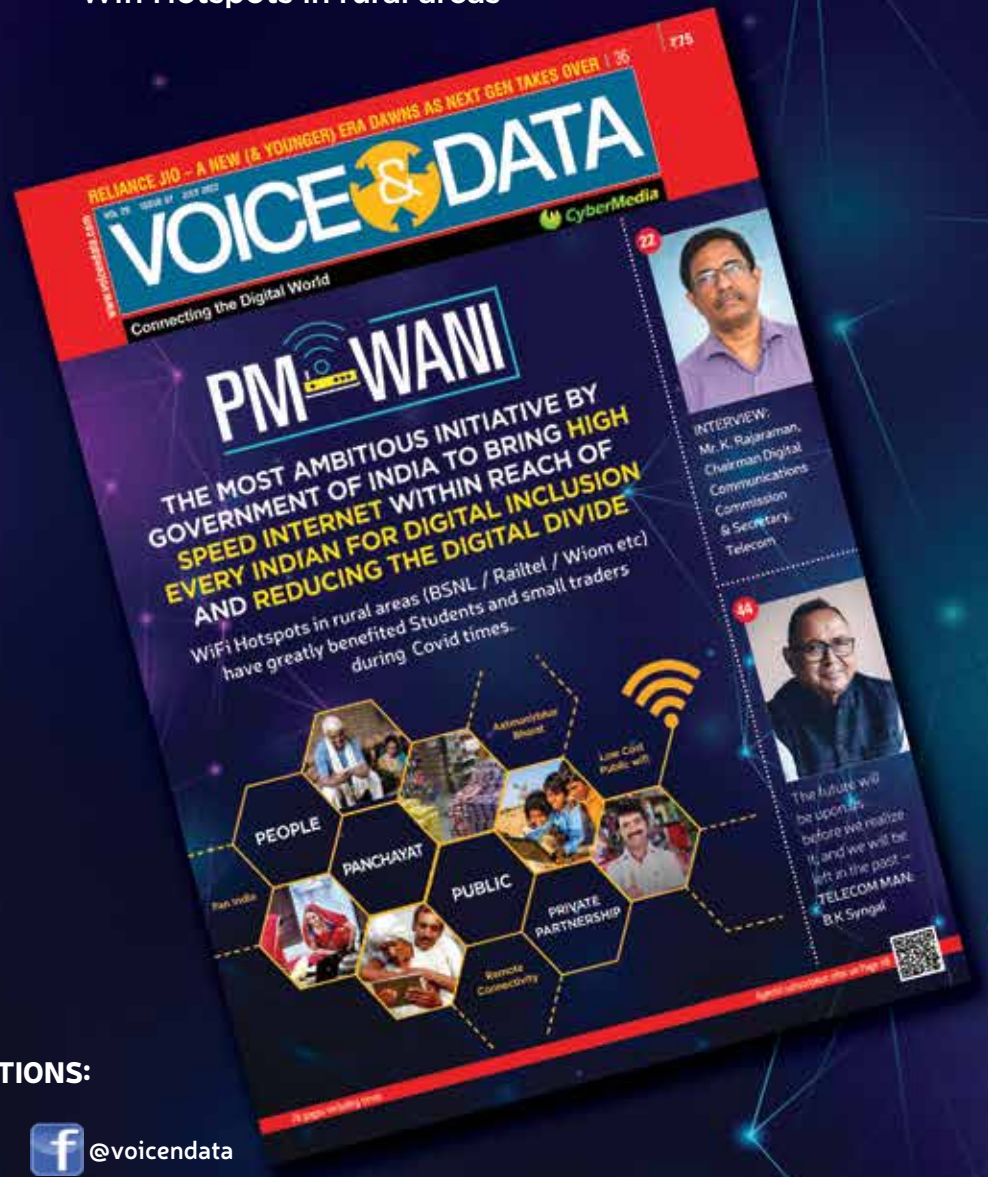**The author is Managing Director and Founder of Dust Value**

Autonomous Car Racing—A paradox, a sharp turn or the final lap of racing?

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CISCO IAC

As bizarre and as bold it may sound, the idea of a racecar without a driver is a cockpit full of mystery, incremental innovations, hurdles and dilemma-packed scenarios. How does this even work? Let's warm up this engine a bit

What's the most fascinating part about F1 racing cars? That they can—in theory, so far—drive upside down for a few seconds? That the driver wears two suits and still loses a couple of kgs due to the extreme heat inside? That back then, in 1950s, safety was all about wearing a cloth-helmet and crossing your fingers that you would come out of the race without a scratch? That the most important part of a driver's training—which, by the way, is years and years—is not the driving but the braking?

How about this? The longest pit-stop time recorded has been a good 43 hours—yeah, it took that many hours to dislodge the right wheel from a big team's car. Sounds weird in an age where we talk of 1.82 seconds when we think of the best pit-stop time. But it is also a reminder that even the most record-breaking human feats start from a humble lane before they go on to smash scoreboards.

Something that's now happening with autonomous car racing. We seem to have crossed the Woodcote (the first corner that drivers tackled in the very first F1 race many many decades back). Let's see how far we are from the ensuing turns. It's a good time to check how tricky the Copse, the Maggots, and the Club are going to be on this strange, but mind-bending, racecourse. More so, as this race is not about a driver's dexterity to brake when required, but of data to accelerate—and in all directions.

▾ Software in the Driving Seat

An autonomous race car is like any other racecar—except the human factor is not sitting inside the cockpit, but outside. Here, the driver is not a human head but a nerve-centre of sensors, wires, algorithms and Machine Learning marvels.

It's now a race where speed, strategy, overtaking, smart turn-steering, and braking

F1 ALABAMA

are being joined by other factors—thanks to the driverless paradigm. It's now also about detecting other vehicles, localizing the vehicle position relative to the opponents and the track while driving at high speeds.

A lot depends on how well a team gets in planning dynamic trajectories to allow overtaking in adversarial environments. It has to be equally fast in correcting at high frequency to the steering angle to stay on the racetrack. Since we have taken the human body out of the suit here, now this vehicle has to fill up every dimension there—including that of thinking on its feet. It has to do a swift performance assessment on its own and carry out adjustments on aerodynamics, energy distribution, differential settings, brake balance settings based on tire wear, temperature and weather. It has to not just

> We are proud of the accomplishments of the Indy Autonomous Challenge so far. We were able to sense, identify, and control our car to pass a competitor car at more than 170 mph. We have broken the autonomous land speed record at over 190mph. This was after only 1 year of on track testing. It will be amazing to see where the next year gets us.
>
> – Prof. Brandon Dixon, University of Alabama

gauge what's happening in this car but also suss out what's happening in the opponent's vehicle.

So how does that happen?

▼ The Constructor Team Shines Here

At Las Vegas, this June, Cisco had galvanized many future-forward demonstrations at the Innovation Tours. And one which popped from far away and grabbed immediate eyeballs and footfalls was—a car. It was sitting at rest, and that seemed so cruel for its true DNA. Coz—It was not just any car. Or just any autonomous car. It was—an autonomous racing car! And it signaled that this concept is already many miles out, and ahead, of the garage. It's not merely something that excites companies like Cisco but also something that has been keeping many University researchers and students busy on their own runways.

There is Purdue University and West Point.
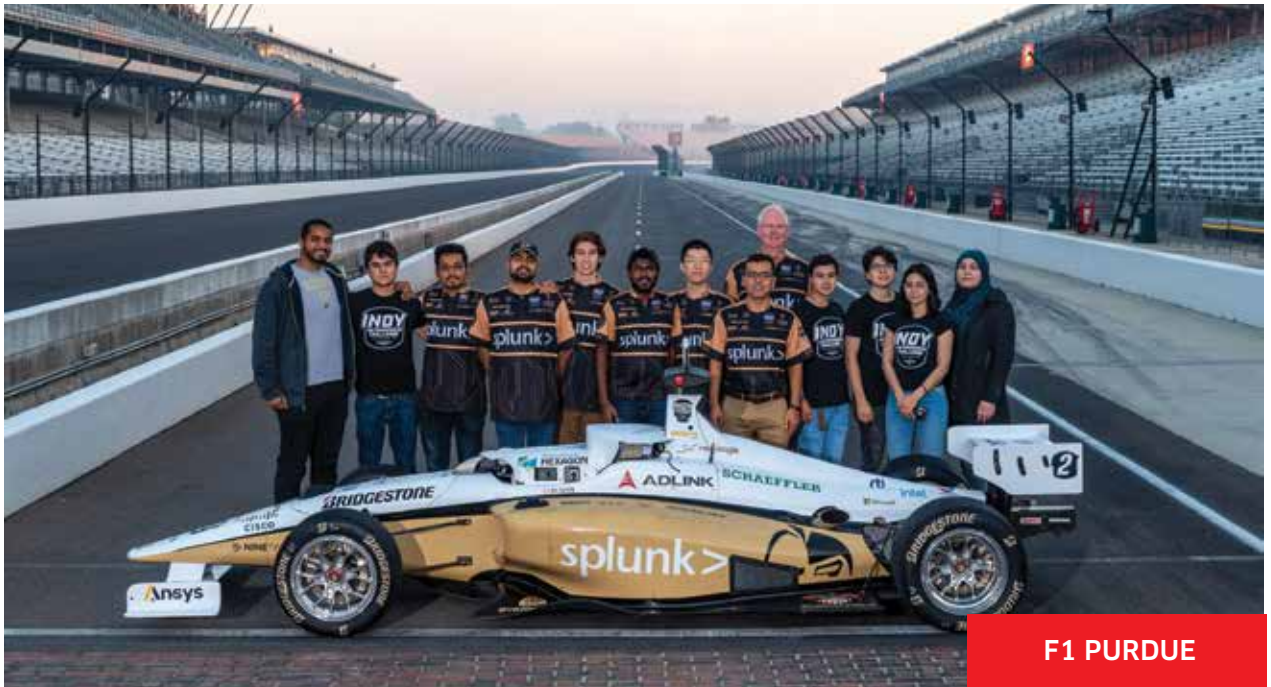
F1 PURDUE

There is the University of Alabama. Then there is University of Auburn, University of Hawai'i and, of course, the big Indy Autonomous Challenge.

Purdue University's work is dominant on the area of the subsystems of autonomous vehicle. It also covers Reinforcement Learning (RL), robot trust and teaming, swarms, human-machine interface, vehicle and path planning behaviors for small and medium-sized ground vehicles, and object classification. The members of the Purdue University Autonomous Vehicles Society have competed in the evGrandPrix Autonomous Challenge. Similarly, when we look at the University of Alabama evGrandPrix Autonomous Challenge we see them beaming—for the team has recently won a momentous race between self-driving cars.

The team PoliMOVE (with Politecnico di Milano, an Italian university, a professor and a graduate student from University of Alabama) won this autonomous challenge at CES. They also competed at the Las Vegas Motor Speedway and won a grand prize.

Cisco, too, has been working on enabling critical car-to-trackside connectivity for the first autonomous race at the Indianapolis Motor Speedway with Dallara-built AV-21 racecars. This would be done using highly reliable, ultra-low latency wireless technology. In the Indy Autonomous Challenge, the teams

Key lanes for an autonomous race-car

- Precision-braking, Collision-free driving in high risk scenarios
- Too many sensors that have to be translated into real-time data
- Dynamic vehicle modelling and load shifts
- Down-force challenges and need for high performance
- Complex navigation and trajectory planning

are responsible for the autonomous driving software, which makes all driving decisions on board. This is done by gathering data from cameras, GPS inputs, and sensors, long-range LiDARs,

It may have been a lonely sport but the idea of autonomous racing is now picking up steam, and researchers, at the pace of greased-lightning. Like what we saw when University of Waterloo students helped to develop a vehicle that will drive itself around Indianapolis Motor Speedway at up to 120 miles per hour. Teams and researchers—like the one at the University of Hawai'i – are working at full tilt

UNIV OF ALABAMA TEAM

to mark their spot in races like the one at the Las Vegas Motor Speedway—where one car gets pitted against another car simultaneously on the same track. On such tracks, the team cars have to pass the other car multiple times during the race. It's a test of how well the cars can handle autonomous navigation. Such cars are also racing themselves against many ceilings like—the fastest lap time, aerodynamic efficiency at high velocities, the ability to continuously change parameters such as tire wear, changing brake bias, and engine maps from turn to turn. Not to forget the agility of communicating strategy, and updates, with the team in the pits—all at a speed which can be as high as 300 km/h.

And of all this boils down to data, network and software. That's where the real race happens then.

▼ Overtaking Oneself

Kyle Connor, Global Transportation Industry Principal, Cisco underlines the importance of data and stresses that all data needs to be

> ▼ Autonomous racing is pushing the limits so that in the future, the autonomous road car will be safer

secure, authenticated, and trusted if it impacts the operation of a vehicle. "A vehicle is theoretically capable of autonomous operations without any outside data (other than visual and GPS). However, the more data that can be considered such as traffic signal phase and timing, pedestrian detection and dynamic speed limits, the better the choice the vehicle can make and the more likely the ability for the roadway to "direct" traffic to improve city life."

But data is also the intersection where a new G force and its pressures come up. Ask Prof. Brandon Dixon, Associate Professor of Computer Science, University of Alabama about the biggest hurdle that we have crossed in terms of technology with autonomous racing and he says that the biggest hurdle that we have crossed is really a compilation of many small hurdles. "It remains difficult to maintain resiliency for decision-making and control in the harsh racetrack environment. The racetrack is a very high vibration and generally difficult environment for the sensors on the car. There are a large number of

F1 HAWAII

sensors providing data, but if you require all sensors to produce accurate data, you might not ever complete a lap. Maintaining good decision making and control in the face of sensor failures and anomalies—that continues to be a large hurdle for autonomous racing."

Issues like high acceleration, low reaction times, unpredictability, high risk environments, and complexity of vehicle dynamic modelling become quite formidable here. Add to that the challenges of downforce, load-shifts due to braking and acceleration, trajectory and collision-free planning for multiple vehicles, the ability to drive the racecar to its limits and high-performance requirements)—all that really sets apart autonomous racing from normal autonomous driving.

Prof. Dixon avers and explains that Autonomous racing and autonomous driving can be compared to human-driven racing and normal road driving—millions of people drive on the road everyday whereas a very small percentage of people can drive a racecar well. "The same goes for autonomous racing. Autonomous racing is pushing the limit of the vehicles at every turn on the track and the autonomous road car is more worried about maintaining the speed limit and keeping the passengers comfortable and safe. Autonomous racing is pushing the limits so that in the future autonomous road car will be safer."

Many of today's autonomous vehicle deployments operate at less than 40 MPH. At 40 MPH cars, are traveling approximately 60ft per second; at 175 MPH, that increases to 160ft per second, Connor zooms in on the critical areas here. "This means that every millisecond counts at race speeds and that there is no room for delays and latency. Thus, 4G/5G type technologies are not sufficient for racing verses slow speeds that are more accommodating of latency. Additionally, when a vehicle approaches 150 MPH, the aerodynamics and the handling change drastically. The first time a team reached 145 MPH, the vehicle spun out under the same conditions that were repeatable and successful at 130 MPH. The teams had to change the code to act a certain way and change as they reached critical speeds."

A lot of help has come from software-hardware evolution, autonomy algorithms, odometry, trajectory simulation, game theory

F1 WATERLOO

simulation, localization sensors, real-time vehicle data transfer and analytics. As Prof. Dixon reckons— all of the concepts above have contributed to the current state of the art. "As computers, sensors and actuators continue to become faster and more responsive, autonomous vehicles will continue to become faster and safer because they can compute more information, make better decisions and the vehicle can respond to those decisions more quickly. The faster the computer can process the data whether it is from faster hardware, faster algorithms or faster simulations the better the decisions can be made by the computer."

We definitely needmore and more vehicle data for better trajectory planning and collision-minimization—but would this not contradict the needs for adversarial driving, competitive analysis etc.?

"More data provides more edge cases that can be verified to being handled. The extra data gives more verification which allows the programmers to make better changes to the algorithms," reasons Prof. Dixon. This should not be confused with needing the data to drive the vehicle. "For instance, a person who has never picked up a golf club could hit a hole in one on a lucky shot but that doesn't mean they will beat the seasoned veterans in a tournament. The data makes the algorithms more seasoned veterans. There is a positive sense of community inside the IAC, but it is still a competitive environment. Plenty of generic data is shared among the teams, but there will always be data and techniques that are held close by the teams. The IAC seems to have a good balance between competition and cooperation."

More data will continue to make the autonomous cars more robust, Prof. Dixon augurs. "There are always small improvements that can be made every day to improve the cars. There is a challenge around every corner and no one big challenge holding us back, instead there are thousands of small challenges."

In the reckoning and experience of Connor, the part of Sub-system integration

> ▼ There will always be data and techniques that are held close by the teams

is challenging. "The vehicles incorporate multiple LiDAR, HD Cameras, GNSS GPS, and other sensors as well as on-board compute, drive by-wire systems, and critical wireless (car to track) connectivity. Integrating these devices to provide and react to critical data in real-time was an initial challenge. While each device is in and of itself is "best in class" the integration was left to university students that have a focus on autonomous software and not in-depth knowledge of system integration, IP networking best practices, normalization of data sets and packet sizes, etc. "Thus, each team designed their own integration methods which resulted in multiple methods that created difficulty in trouble shooting issues from one vehicle to another, he explains. "This hurdle had to be overcome as quickly as possible to ensure safe operations that were predictable and controllable."

And what about the 'freezing robot' problem? It's plausible and if it happens in

> 💬 "The lessons learned from the Indy Autonomous Challenge and the continued improved perception of autonomous vehicles (trains, cranes, mining vehicles, and consumer cars) will proliferate across all industries and communities. It was very exciting to see Cisco IoT products standing up to the most extreme conditions (heat, cold, vibration, reliability, etc) to safely operate the world's fastest autonomous land vehicle."
>
> – Kyle Connor, Global Transportation Industry Principal, Cisco

an actual race, the consequences can be quite risky. Answering that Connor reflects on how, for the Indy Autonomous Challenge, the team operated on a closed track that had purpose-built wireless technology for emergency control to overcome "freezing robot" if needed. "The real world is much more challenging and has much less safety technology in place for autonomous vehicles. The Indy Autonomous Challenge was ONLY autonomous vehicles verses the real world having a mix of autonomous and human driven vehicles. In

> ▼ Autonomous racing can be just as enjoyable from a fan's perspective as normal racing. The only difference is that the fans will cheer for a team of programmers instead of a single driver.

the real world, cars do not have them same "rules" and thus more predictable outcomes." He tells, candidly.

▼ The Real Podium is Somewhere Else

At the face of it, these racecars may seem like fun experiments—pumping the usual race-adrenaline. But a lot of work happening on these tracks can get beautifully transported to enterprise use-cases—if not immediately, then at least, in the near future. Like use of connected robots on a factory floor, or driverless vehicles in high-risk areas like oil

Under The Hood

Small-scale or reduced-scale vehicles were the first creatures in the autonomous racing species.

They were mainly derived from remote controlled (RC) cars. In the next bigger size, researchers use modified 1:10 scale RC cars for their autonomous racing research. In the last few years different institutions released their documentation for both hardware and setup of these 1:10 vehicles. That explains versions like the Berkeley Autonomous Racecar, the MIT Racecar, the MuSHR racecar, the RoSCAR or the F1TENTH vehicle from the University of Pennsylvania. A special version of an autonomous small-scale vehicle is the so-called AutoRally vehicle, a 1:5 scale autonomous racecar developed by a team of researchers from Giorgia Tech.

In these cars, the sensor setup is interchangeable – thus making space for application monocular cameras (e.g. Raspberry Pi, OpenCV OAK-1), stereo cameras (e.g. ZED, ZED2, Intel Realsense d435i, OpenCV OAK-D), 2D LiDARs (Hokuyo 10LX, Hokoyu 20LX), IMU, indoor GPS or wheel-speed sensors. Embedded GPU systems like the Nvidia Jetson (Models: TX1, TX2, NX, AGX Xavier, Nano) appear as the main computation platform. This gives the possibility to speed up the inference of DNNs.

Source: *Research Paper on Autonomous Vehicles on the Edge: A Survey on Autonomous Vehicle Racing by Johannes Betz, University of Pennsylvania and other authors*

Accidents and Data

Given that the Dallara AV21 vehicles with all of the technology can cost around $1M, the cars are owned and operated by universities – rather than corporations or pro-race teams that have millions to invest and own multiple vehicles in case of damage. To reduce risk and the associated cost of a wrecked vehicle, each team had to pass multiple rounds of simulated tests. Many teams were collecting terabytes of data each day and incorporating it into their simulations prior to making any real-world changes to the vehicle. Real-time vehicle data was a mandatory aspect of the challenge and the Indianapolis Motor Speedway to allow for emergency control of the vehicle in the event of an on-board failure/error. The real-time data also provided teams with the ability to track their vehicles and send start/stop commands per the race rules.

-*Kyle Connor, Global Transportation Industry Principal, Cisco*

drills and minefields. A fast, but smart, driving technology can come in very handy with driverless trains, self-run warehouses, robot-powered factories and so on. Many industrial scenarios could use the high levels of speed and data actionability that we achieve with autonomous racing. The more we break records of network bandwidth, zero-latency data, fast compute and high safety here—the more our real world situations can gain from these turning points.

This brings to fore network-related aspects like backhaul connectivity, car and trackside connectivity—and low-latency communication—because they can bring a lot of edge to this game. As Connor dissects, the communications were a requirement for safe operations. "Clemson University ICAR program evaluated multiple types of communications technologies and concluded that Cisco's Ultra Reliable Wireless Backhaul was ideal for these speeds and reliability. These same technologies drive some of the world's coolest amusement park rides, fastest trains, and most remote mining vehicles. Achieving successful autonomous operations at 192 MPH gives good prospect that Cisco can help to automate most any environment for most any industry."

For now, the concept is making a dash beyond experiments to race-track reality. "I think we have already passed the concept level in Vegas when we were able to have multiple cars on track passing at very high speeds. I think autonomous racing can be just as enjoyable from a fan's perspective as normal racing. The only difference is that the fans will cheer for a team of programmers instead of a single driver. It is no different than watching football where you are cheering for a group of players instead of a single player. The human safety aspect will improve because the drivers are no longer at risk to injury." Prof. Dixon assures.

Who knows that, soon, the most fascinating thing about Formula racing would be that there are no accidents or fatalities during racing! Would a 'no-human-in-the-seat' still keep the sport an 'edge-of-the-seat' one? It has, after all, the risk of turning into another videogame. But, then, it also has the possibility of turning even more exciting in the circuit of AR/VR and Metaverse. It's not a co-incidence that this sport has always been as much about racers or drivers as it has been about the geeks who accelerate the technology inside it. Who knows now is the time for the geeks to really shine!

Like always—it's about where the car steers next. ∎

Use social media for support, awareness and removing barriers

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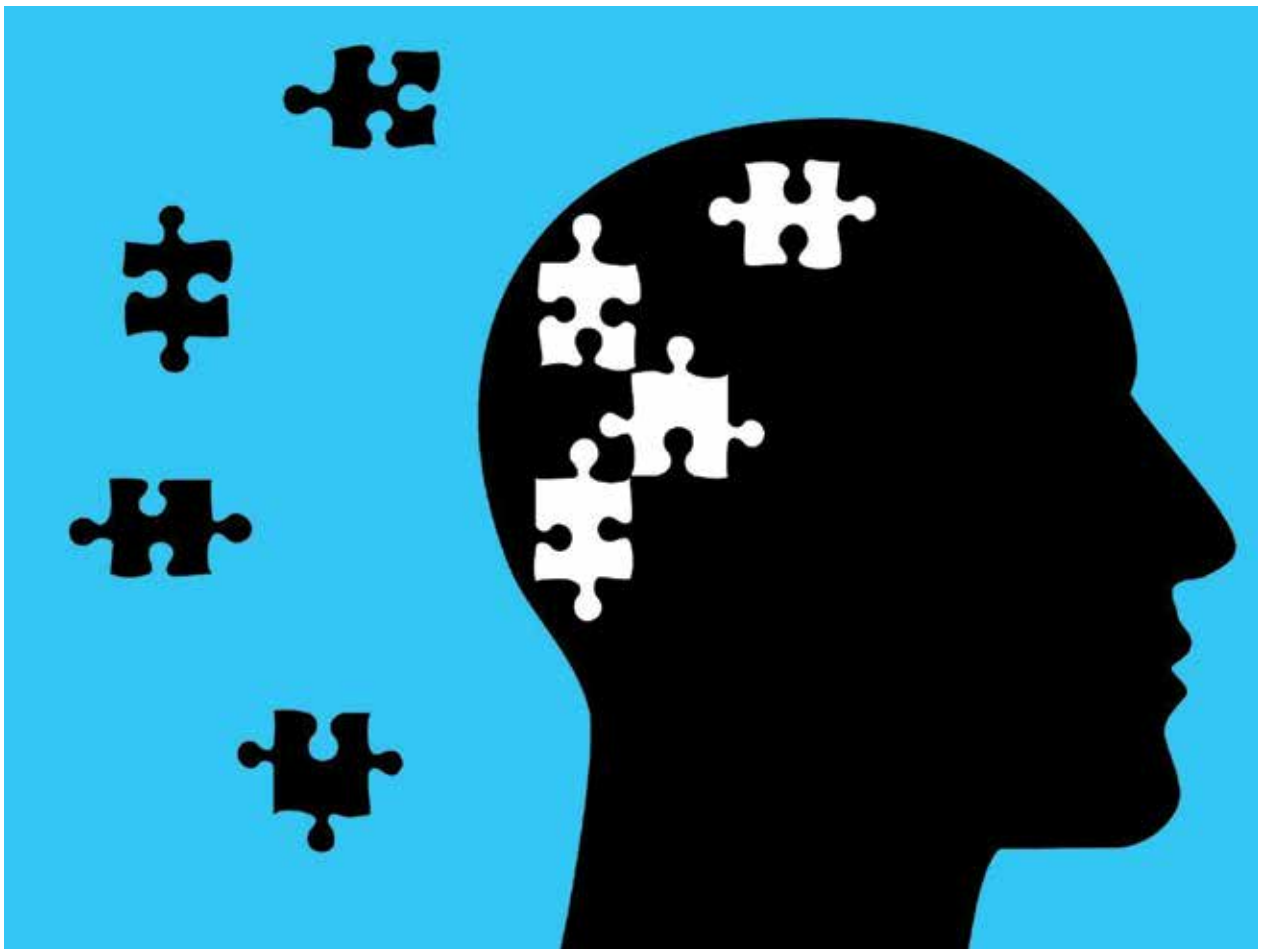
With a good therapeutic relationship and a mobile or online platform, most aspects of mental health treatment are still possible, says *Deepak Singh, Co-founder and CEO, Tatsam: Mental health & holistic wellbeing*.

▼ **Do you think mental health is one of the most neglected issues in the world today? What is the India situation and how have things changed thanks to the pandemic-lockdown?**

The problem is big but the key thing we want to highlight is that we can improve it. When we consider the statistics, it doesn't paint a positive picture — the WHO estimated in 2019 that 970 million people globally (or 1 in 8) suffer from a mental disorder — with anxiety and depression being the most prevalent. It is one of the leading causes of disability in adults, 20% of children and adolescents are diganosed with mental health disorders, and suicide is India's second leading cause of death for 15-29-year-olds. Post Covid-19 these figures have increased by at least 20%.

It is important to remember that mental health issues affect more than just a person; they affect their family, their occupation, their community, the economy, and society as a whole as well. In general, the younger you are when developing a mental health condition, the higher the chance of it being a life-long condition. Similarly, children whose parents suffer from mental illnesses have a higher chance of developing one themselves. This creates a cycle of mental health problems and it can have a widespread impact.

We don't exactly know the potential impact of Covid-19 yet — is speculative from a social, economic, individual and public mental health perspective. Most research and policy makers predict "sleeper effects" in children and the Indian youth — meaning people may develop more mental health challenges in the future. What we do know is that Covid-19-related stress, fear and loneliness; relapse of pre-existing mental illness: due to reduced access and disruption to therapeutic resources and therapy, less social support combined with the psychological effects of misinformation, loss of peer support because of closure of schools and offices, medical comorbidities, uncertainties, stigma and prolonged isolation have all aggravated and increased mental health challenges and mental illness globally.

Tatsam's research post Covid-19 found that India has one of the highest treatment gaps in the world with almost 90% of people not receiving adequate care or living with

DEEPAK SINGH, Co-founder and CEO, Tatsam: Mental health & holistic wellbeing

an undiagnosed condition. There is also a huge sub-clinical population in India who don't meet diagnostic criteria for an illness but still struggle on a daily basis with their mental health. This number is increasing exponentially. Because mental health disorders are still highly stigmatised both within our society and even within our healthcare system, discrimination, stigma, and human rights violations are frequently experienced by people with mental health conditions. This leads to feelings of shame, guilt, and denial by both individuals and the families of people with mental health concerns, affecting their willingness to seek help and often preventing them from seeking treatment.

The silver lining is that many mental health conditions can be effectively treated at relatively low costs, especially when we leverage technology. Increasing awareness, reducing stigma and most importantly improving access to care and making it easier for people by reducing misconceptions around mental treatment interventions will create a lot of change. It's important that people

understand that you can work on mental health and you can build positive habits around your mental health. Just like you can improve your physical health.

▾ What do you think of digital mental health? Usually we see it negatively thanks to social media. Can the digital world actually be used to make mental health better?

Globally there has been an extensive amount of research conducted post-Covid to understand how technology can be leveraged to reduce the treatment gaps we are currently experiencing. Social media can have a negative impact on mental health, but it can also be used to increase support, improve awareness and remove barriers to help seeking.

At Tatsam we prioritise safeguarding our users and we've done a considerable amount of research in 2021 and 2022 on which interventions are most successful and effective on a digital platform. In addition, we've incorporated guidelines defined by the National Institute for Health and Care Excellence UK (NICE), Public Health England and the NHS, as well as the 2022 the American Psychological Association's evidence standards framework for digital health and care technologies in all our pathways.

For example, a unique aspect of our product and the app pathways is that we offer both unguided and therapist guided intervention modules, we've also integrated mobile application interventions with digitally enabled psychological therapy that is provided online with the support of a therapist. With a good therapeutic relationship and a mobile or online platform, most aspects of treatment are still possible. It is relatively easy for a clinician to overcome many of the challenges involved with this type of delivery when an initial online meeting has already been established and developed a collaborative relationship. Regardless of whether users use guided or a guided mobile app based solution,

Tatsam offers a free initial consultation with a therapist and encourages users to have regular online checkups to address the potential limitations of delivering mental health treatment remotely. As a result, the evidence-based systems in Tatsam's product can maintain a high therapeutic alliance and result in equally positive outcomes when compared with traditional psychological treatment.

▾ Can you reveal a bit about the Tatsam app and how it is helping working professionals?

Mental health challenges are now the norm among employees across all organisational levels. A total of 76% of people reported at least one symptom of a mental health problem in our research in 2021. Despite the many macro stressors post-Covid-19, that supports the notion that most of us experience mental health challenges regularly.

▼ 76 per cent of people are suffering from at least one symptom of mental health problem.

There are 3 components of the solution which include the app: the first is a simple, easy-to-use mobile application with pathways to support individual needs that offers a free guided session with a therapist; the second is therapist and community-led support groups and group sessions; and the third is working individually with a therapist online on personal concerns. The interventions are all integrated and can be used individually or in combination.

We want people to understand that anyone can benefit from therapy and support their mental health with self-care. It's important for people to know that they can seek therapy for a range of reasons – managing and balancing the demands of parenting, work and family responsibilities, coping with medical illness, improving relationship skills or managing other stressors that can affect all of us.

On the mobile application, we offer seven pathways that combine self-guided and semi-guided (therapist-led) pathways to address the varied and personal needs of people (based on Tatsam's research). Alongside "Peak

Potential" and "stress," aimed at encouraging mental health habits and reducing burnout risks, there are also pathways for the more debilitating issues of depression, anxiety, and chronic pain.

▾ What has been the feedback and experience of Tatsam in the last few months since the launch?

We were taken aback by the overwhelming and positive responses we've had to the platform on social media. It's really underlined for us how much people are looking for solutions for mental health that are high-quality, non-judgemental and empathetic. Our experiences over the last few months also highlighted the number of people who need but cannot afford quality treatment. We've received emails and messages from young people who want help but are afraid of judgement, stigma and who have also had negative experiences with mental health professionals in the past.

It has really reaffirmed our mission to make a difference. This led us to create a financial aid programme to help people with diagnosed and/or life course conditions such as Major Depressive Disorder, Social Anxiety Disorder, Personality Disorders and ADHD receive treatment from our trained practitioners at a significantly reduced cost.

▾ Can you explain what Tatsam Business Solutions is and how it works.

For businesses, in addition to the employee-facing app described above, we provide statistical wellness audits which can help them understand where they stand in terms of indices like social wellbeing index, happiness index, overall psychological capital etc. We also help them design mental wellbeing strategy map and calendars, and conduct engaging workshops on mental health related topics.

Our business solutions basically help organisations improve employee wellbeing and build a more productive, happier, and resilient workforce. Individuals can enhance their mental and physical wellbeing and fuel both their professional and personal growth via Tatsam's mobile tools, resources, and community support programmes. Employees can learn the skills, behaviors, and mindsets needed to perform at their peak, both professionally and personally, using app solutions and support. ■

The Data Must Flow: Metaverse Edition

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Source: @TextlessPoster on Twitter

What role data and metadata will play for the metaverse to succeed? Ownership, usage and adoption of the data & data policies will also be covered

The beginning of the Metaverse is a very delicate time. Know then that it is the year 2031. The known Metaverse is dominated by the BigTech combine, our overseer. In this time the most precious substance in the Metaverse is our data. The data extends record profits. The data expands their AI's consciousness. The data is vital to an ad driven metaverse economy. BigTech's ability to refine data has evolved over 40 years and they use our data to provide even deeper targeted ads that are to target any user in the known Metaverse and beyond.

Oh yes, I forgot to tell you, the data that BigTech uses is created in its entirety by us. A select few of us on the Metaverse have long held a prophecy that a better, more equitable version of the Metaverse would come built on open, interoperable protocols, that would lead us to create true impact and have control and sovereignty over our data.

If this opening sounds familiar, it's my take on the original Dune's opening, for in the current mainstream Metaverse narrative, the data must truly flow. I've always been a science fiction and fantasy buff and Dune has been one of those classics for me. I'm no Paul Atreides though, just a humble data engineer who's trying to build a better internet with aligned incentives and an information collateral driven economy. I also happen to be a big XR fan and relative early adopter tinkering with a few projects on OpenXR with my VR headset. If what you've read so far is a little too much to digress, take a minute. From my unique lens, in the rest of the article, I will be covering what role data/metadata will play for the concept of Metaverse to succeed. I will also touch on what regulations we have today around the metaverse and our data in India and abroad and lastly, my take on an ideal Metaverse. So let's dig in.

Like Spice, data too must flow for the Metaverse to succeed. A quick primer on what I hold as the definition of the Metaverse: A more interactive version of the internet that leverages our five senses better. My definition is fairly vague and open ended on purpose, as I feel typical definitions, you'll come across restrict creativity and innovation on what can be possible. Today, almost every big tech company is in the middle of a serious capex

NIKHIL KURHE, CEO & Co-Founder, Finarkein Analytics

cycle for their Metaverse ambitions.

Apple's Mixed Reality headset leaks peaked prior to their WWDC, Microsoft has been building on the Hololens with the latest iteration being the Microsoft Mesh SDK, and Facebook, now Meta, probably doubling down the hardest with their new wave of Oculus/Meta headsets. I would say Google was one of the earliest movers with their infamous Google Glass, and while it didn't quite go as expected for them, it did lay the foundation for their upcoming AR headsets under Project Iris.

A series of smaller startups like Lynx, Varjo are also building, selling and delivering on the hardware front, which is extremely difficult to pull off when you are resource constrained and don't have billions to deploy. The hardware is just one part of the equation though, software is equally important. Companies like Ultraleap and Tobii are leading the charge to solve for our senses like seamless hand and eye tracking respectively. On the framework/OS side, you have options like SteamVR, OpenXR and BigTechs bringing their own flavors soon enough as well. The point is that to orchestrate a Metaverse, there are a lot of moving parts that need to come together seamlessly even to build the current cutting edge XR experiences we have today.

Data plays a pivotal role and is the fuel for the current experience. 4-6 cameras, a few microphones and additional sensors

are generating constant data streams which may be processed locally, or on the cloud, depending on the hardware and the software. Even if we remove XR as a medium and restrict our Metaverse to regular mobile devices, you know latency and performance are of utmost importance for seamless end user experience. As a result, to improve on all these aspects, significant data crunching happens both on device and on the cloud. A quick glance through the Oculus Data Policy for Meta is telling. Everything from your physical features (height, hand size, dimensions) to the content you create on their platform to the interactions itself is all collected. Information from third party apps and services to better cross reference your data is also something we as users are opting in for.

Critically, Oculus shares information with related companies, including other Meta Companies as well. Microsoft has a slightly more reasonable take wherein they've bucketed data into optional and required diagnostic data. While I understand why the data is required and how it can lead us to the version of Metaverse we're looking for, users should at all times be aware and have an option to consciously opt in/out without encountering any dark design patterns.

Data plays a key role in building a Metaverse with a persistent state and provides a robust economy. Interoperability, while easy to wish for, is ridiculously difficult to implement practically. Every stakeholder needs to align on the standards. There is precedence for this though like the TCP/IP stack, SMTP, FTP and various other protocols that power the internet all evolved from the core need to accessibility and interoperability. I am personally rooting for OpenXR to lead the charge here, and yet again anonymised data and metrics will matter here.

Switching gears to a legal perspective, there are very little checks and balances in place today for the Metaverse. Trust, privacy and security are somewhat of an afterthought for the early adopters. Regulators, legislators and end users are behind the curve as innovation remains significantly ahead, as is usually the case. It's no excuse though to treat the Metaverse as a new gold rush opportunity though. I feel companies who try to take consumers along and keep user interests will carve out a niche and eventually force better behavior from the rest. Things like a dispute resolution mechanism and/or a legal framework for Metaverse issues is obviously non-existent today. As things stand, we're indeed at a time where everything is up for grabs and will evolve on the legal front. I do not expect India to take a lead on the legislation front based on the pattern we've seen so far. Economies like Japan and South Korea in my opinion will lead the charge here.

> ▼ Data plays a key role in building a Metaverse with a persistent state and provides a robust economy. Interoperability, while easy to wish for, is ridiculously difficult to implement practically.

Anyone who's coming here expecting Ready Player One to be the ideal Metaverse, should really read the book. An ideal Metaverse in my opinion will be one which is open and accessible to all, built on global open and accepted protocols and data standards to facilitate seamless information exchange and value creation. Even on the computer front, to see the version of Metaverse we've been fed, a 1000x computer leap is required. Moore's Law will barely get us there from an hardware perspective, post which we will have to rely on the software to bridge the gap. Therefore, I believe this version of the Metaverse is probably a decade out, but there are encouraging signs on the software stack. Features like foveated rendering, upscaling like Nvidia's DLSS, AMD's FidelityFX and as of yesterday, Apple's MetalFX are all collectively laying the blocks for that ideal Metaverse. Somebody needs to now step up and maybe go after the Modern Data Stack for the Metaverse. A Metaverse built on an open data stack with principles like Privacy by Design, security baked into the transport, storage and communication layer would be what I would love to see a decade out. Regardless of which Metaverse version we end up in though, the data will flow. ∎

The author is CEO & Co-Founder
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Metaverse comes with its own set of potential concerns

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With all new technology, however, come inherent risks and that rings true for Metaverse as well. Hence, addressing those concerns should not be an afterthought in their adoption

The term 'Metaverse' has gained sudden popularity over the last year, with people across the globe fascinated by the endless possibilities this virtual world holds for the future of social, business, leisure, and culture. While Mark Zuckerberg popularized this term, tech brands across the world have been working towards a virtual world for many years, with technologies such as virtual reality being a step in this direction.

In fact, the word 'Metaverse' was first coined in 1992 by the author Neal Stephenson in his novel, Snow Crash. Since then, there have been many versions of the metaverse. For example, the gaming industry nurtured the idea with games such as Second Life, Eve Online, Grand Theft Auto, and Red Dead Online.

However, as the metaverse continues to grip the world's imagination, there is no doubt that we will need an investment in the development and adoption of edge computing, as current centralized cloud computing deployments will not be enough. Placing computing and storage closer to the data sources will bring in immersive virtual experiences.

According to the State of the Application Strategy report 2022, 85pc of Indian businesses plan to deploy workloads at the edge. 33pc of Indian respondents said that improving operational efficiency with more accurate data/insights from remote endpoints, while 27pc pointed towards improving customer experience with better app performance as the primary business outcome they want to achieve using edge computing.

▼ The Threat

Metaverse might be a big promise in the evolution of applications, however, it comes with its own set of potential concerns - the biggest being security and privacy. While much is being reported on data collection and privacy, an equally important area of concern is the reliance on social networks to verify identities. Non-commercial users of social networks like Facebook are likely to use their actual personal details to engage with their friends, family, and broader social circles, giving rise to Open ID Connect (OIDC) technologies where third-party services can leverage identity and personal information details with a user's permission,

SHAIN SINGH, Principal Security Architect-APCJ Lead, F5

e.g., logging in to Spotify with Facebook details. While this creates an environment where there are fewer logins and passwords to remember, it also means that social network logins are now a target for identity theft. Moreover, moving from the digital world to the virtual metaverse also increases the threat surface for fraud and identity theft, and the integration between physical and virtual spaces gives malware the ability to move between physical and virtual environments.

▼ Mitigating Risks

The key to battling these risks is to have the right operational procedures and relevant safety models that can adapt to the metaverse. Adopting a Zero-Trust cyber security model, for example, can help ensure only the right people have access to the information at the right time. The 'Never trust, always verify, continuously monitor' approach can further build trust and mitigate cyber threats in the metaverse. In addition to this, these threats will increase the existing demand for tools such as VPNs, proxies, and anti-malware software to strengthen security. Advanced web application firewall (WAF) and Web app and API Protection (WAAP) solutions can further help organizations protect their unsecured endpoints while monitoring and responding to attacks in real-time and gain end-to-end visibility.

To conclude, the metaverse is bringing with it endless possibilities for how we interact, engage and work. With all new technology, however, come inherent risks and these should not be an afterthought in their adoption. ▪

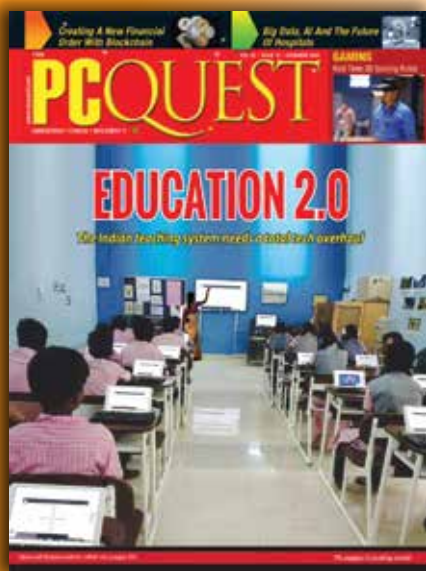*The author is Principal Security Architect-APCJ Lead, F5*

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Beginning Your Data Analytics Journey

Ashok Pandey
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The Oil of digital age – Data, and engine of a business is analytics. Utilising the data with right strategy enables informed growth and transformation, not just incremental efficiency gains

Every business can leverage their data to drive improved decision making. The complex business problem can be solved by connecting the dots with data, seeking deeper understanding of your customers, etc. Data analysis can help understand your customers, evaluate performance, personalize content for respective audiences, and develop new products in line with the trends. Enterprises can leverage data analytics in enhancing business performance and drive your organization into the future. to understand how a business can begin their data analytics journey, role of cloud computing and more, we spoke to *Naren Vijay, EVP-Growth, Lumenore*.

▼ The beginning of data analytics journey

The era in which businesses could thrive without data analytics is now extinct. The Internet of Things (IoT) continues to support exponential data volume and rate growth. Today, we live in an era of rapid technological advancement, providing ample data opportunities. Data analytics is a business asset that should be prioritised alongside revenue, customer satisfaction, and profitability. However, to leverage the maximum from data analytics, businesses must be clear about the problem they are trying to resolve, their KPIs & business goals, TG, Revenue Target, etc. Once this is formulated, the organisation should create an analytics roadmap that aims to translate the intent of the data strategy into a plan of action. It should outline how to implement the key initiatives. A business-specific Analytics Roadmap will guide the business through the necessary requirements before taking the next steps. The roadmap prioritises which key performance areas should be addressed first and second, based on the knowledge of business stakeholders and, more importantly, data-science knowledge of where analytics can truly add value.

Building a Data Universe accomplishes making raw data accessible to users at all organisational levels. The design of systems allows firms to reduce the complexity of

NAREN VIJAY, EVP-Growth, Lumenore

managing data through Data Universe. The maturity of an organisation's analytics improves its competitive position. As disruption continues to impact virtually all industries, the combination of historical and near-real-time data, as well as the ability to merge and analyse this information, gives businesses a competitive advantage.

▼ The conversational intelligence & predictive intelligence

Conversation intelligence uses artificial intelligence, machine learning, and natural language processing technology to extract values from data in order to answer questions, deliver quality service, or improve customer support. This feature helpsleverage instant insights which can be used to make successful business decisions. These conversational AI systems have been used in banking, retail, and marketing, among other fields.

Predictive intelligencehelps in spotting outliers in data, identifying risksand getting accurate forecasts. It monitors the market and customer behavior to provide insightsinto the market trends Harnessing

the power of conversational intelligence and predictive intelligence has changed the face of industries like healthcare, pharmaceuticals, education, retail andautomotive sector,and enabled them to better serve their customers.

Predictive Intelligence is a gift for the industries like healthcare, retail, automotive and financial services. This solution was widely used in many countries by healthcare professionals during the onset of Covid-19. This has helped them in the regions which can be highly infected, predict the number of Infected patients and availability of medicines and other medical supplies. Similarly, industries like retail and automotive could forecast the demands and risks, which helped them in managing costs and resources.

Conversational Intelligence, on the other hand, helped each of these industries to get instant insights. It helps in easily accessing the informationthat assists in managing inventories, resources, and supplies.

▼ The role of cloud computing in business analytics

Business analytics and Cloud computing are an ideal combination for industry verticals. Cloud computing offers vast opportunities for innovation and potentially the disruption of entire industries. Along with storage solutions, cloud computing offer advantages over conventional on-premises systems, including cheaper running costs and greater compatibility with digital organisations' work habits. Cloud computing is the supply of computing services, including servers, storage, databases, networking, software, analytics, and intelligence, over the Internet (the cloud) to provide speedier innovation, scalable resources, and economies of scale.

Businesses have employed data analytics to guide their profit-maximising strategies. Ideally, data analytics aids reduce much of the guesswork involved in attempting to comprehend clients, instead systematically

recording data trends to construct the most risk-averse business strategies and operations. The combination of cloud computing with data analytics would enable organisations to store, understand, and process their big data in a manner that better meets the demands of their customers.

▼ Data visualization can aid businesses in making decisions

Data visualisation can make a difference by facilitating rapid comprehension of vast amounts of information. In fact, data visualisation has become so pervasive in our daily lives that it can be difficult to recognise all the benefits it provides. Numerous daily activities, including watching the news, completing schoolwork, and determining which foods are healthy, are facilitated by graphical representations of data. The primary advantage of data visualisation is the presentation of data patterns. A visual representation of the available information can save individuals and businesses the time and effort required to perform data analytics independently. The four ways in which data visualisation enhances decision making:

- **Data visualisation tools accelerate operations -** Visualisation tools provide decision-makers with a reliable organisational framework, allowing them to comprehend their potential options quickly. Without data visualisation, organisations may fail to identify developing problems, forfeiting the opportunity to address them before they become incredibly harmful.
- **A data-driven decision is more accurate** - Data visualisation tools present voluminous amounts of data in an understandable visual format. Using data visualisation tools, business leaders can make decisions without relying on assumptions.
- **Visualisation simplifies data-** Data visualisation facilitates communication

> ▼ Cloud computing offers vast opportunities for innovation and potentially the disruption of entire industries.

for all parties. It enables an intuitive and straightforward communication of valuable insights from complex datasets. Not only does data visualisation facilitate comprehension, but it also reduces the transmission of its contents to others.

- **It improves cooperation -** Data visualisation ensures that every team member is up-to-date on the facts, saving time that would otherwise be spent on verbal communication or answering redundant questions.

▼ Building insight-ledculture without compromising on the data security

Business intelligence platforms allow users to import, cleanse, and analyse information from databases, emails, videos, and other sources. These data analyses provide mobile, desktop, and real-time business intelligence to enable decision-makers to improve their organisation based on insights. BI platforms would allow users to personalise dashboards, generate stunning data visualisations, construct scorecards, and compare them with key performance indicators (KPIs). Today, the adoption of big data analytics is expanding rapidly across all industries.

The difficulty, however, is that big data analytics platforms are typically stuffed with a vast quantity of products, partners, customers, and other data. This data typically has inadequate data security, providing cybercriminals with an excellent opportunity. By having the right partner on board, organisations can safeguard their data and drive maximum results. Using a BI platformand analytics tools are also essential for protecting the organisation's sensitive data. The use of BI tools to create an access system that drastically reduces the likelihood of an attack. ■

Technology in a Cloud Kitchen – Hot or not?

Pratima H

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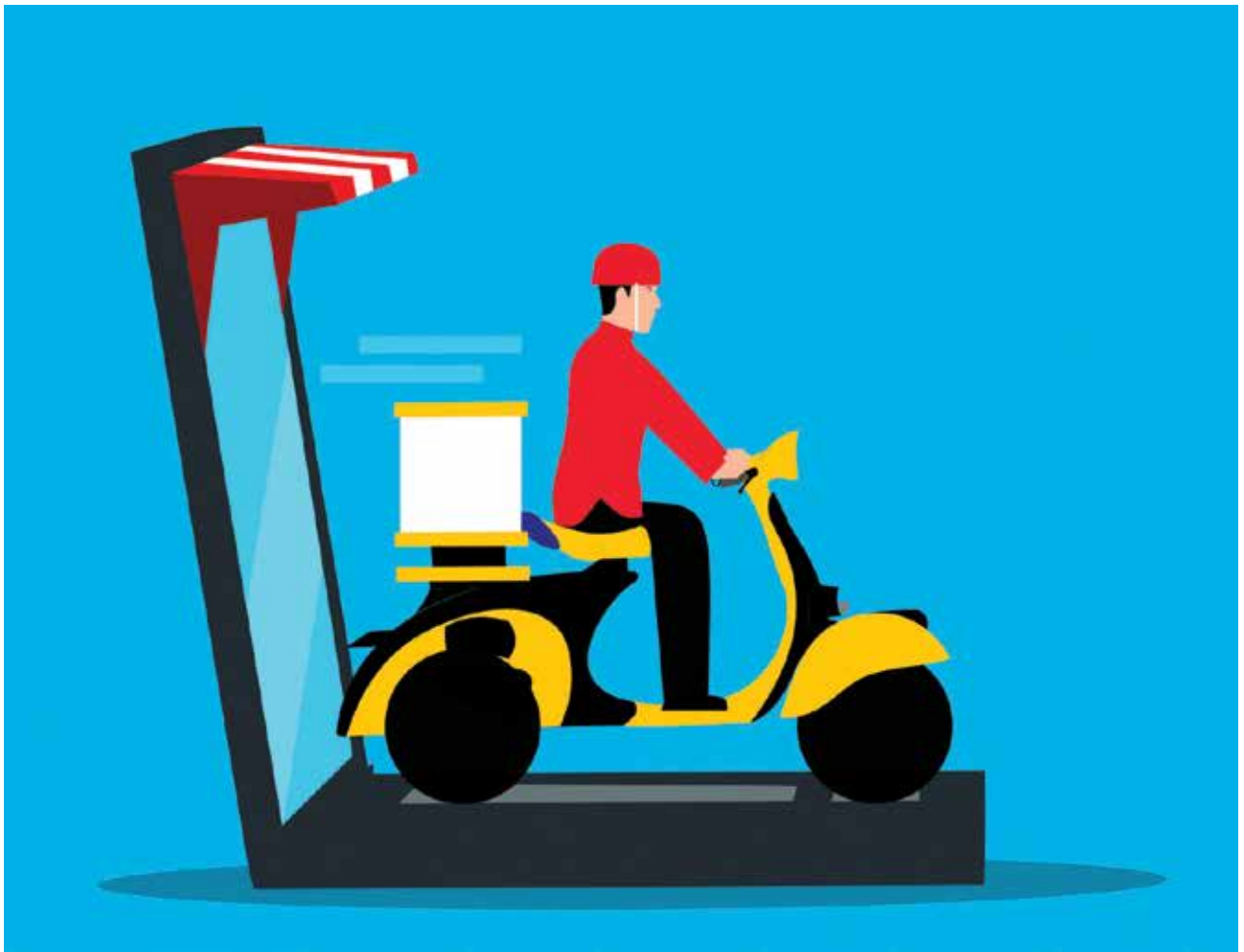
Why is a kitchen mixing in AI for predictive demand modelling, tech platforms for just-in-time preparations, and robotic arms for cooking at scale? And how can it make sure not to get by Cloud outages? Time to sniff deeper

As per an Allied Market Research report, the global cloud kitchen industry stood at $29.4 billion in 2020, and can touch $112.7 billion by 2030. Here, the independent cloud kitchen segment has held a major share with around two-thirds of the global cloud kitchen market. At the same time, the kitchen Pods segment can show the highest CAGR of 14.62 per cent from 2021 to 2030, thanks to its low operational cost and its waste-reducing, eco-friendly offerings. Also worth noting here is the prediction that the market across Asia-Pacific is expected to register the highest CAGR of 15.07 per cent from 2021 to 2030. Let's get into a Cloud kitchen in India – and find out what role the ingredient of technology plays here? *Ankit Nagori, Founder, Curefoods* shares his recipe.

ANKIT NAGORI, Founder, Curefoods

▼ Thousands of meals per day! How do you balance speed with quality, hygiene standards, minimum wastage, taste, and consistency? Is it hard to meet the needs of high customer impact while maintaining employee satisfaction and sustainability, minimising worker/delivery staff fatigue, and aiming for profitability?

Curefoods currently does around 40,000 meals per day. In my opinion, the ability to meet speed with quality, hygiene standards, minimum wastage, and consistency comes with following a process. At Curefoods, we do this through our three clustered kitchens and one large bakery, which does most of the semi-preparations for the deliveries like gravies and marinades. More than 50-60 per cent of the preparation is done through these kitchens and is controlled through our technology and manufacturing lead platform, which is farm-to folk. This food is then moved to the cloud kitchens based on demand modelling technology. Just-in-time preparation is followed to ensure that a customer's order is delivered in less than 30 minutes. I believe that this overall process is critical. The fact that we have technology that enables us to service many orders, especially in the peak hours of demand, is beneficial and vital, as this is when the real business is generated. Curefoods can deliver to the demand in a very clean manner.

▼ How critical is technology for a Cloud Kitchen? Are you using Deep Tech like AI, ML, Blockchain, Robotic assistance etc. already?

The functioning of a cloud kitchen has multiple aspects, where technology plays a vital role.

The first is demand. Running your brand's website and application is crucial to generating a robust user demand. Apart from your platform, getting access to all the other major food platforms in the market like Swiggy, Zomato, Amazon and others, and displaying your brand on their portal will also generate the demand which needs deep integration with each of the third-party brands.

Second is the entire logistics that takes care of moving food from one point to another, from raw materials to the kitchen to the customers. This tracking, and role, of logistics require a lot of technology integration, given the high demand volumes in the market today.

Lastly, deep knowledge of technology and deep tech platforms is required to decide the food production and its quantity, inventory management, and batch processing.

That said, at Curefoods, we use AI in terms of predictive modelling of demand, which helps us decide on food production and reduce its wastage. We have some robotic hardware installed in our kitchens, which allows cooking on a large scale.

How do you differentiate yourself from other players in this space through

clever and ahead-of-the-curve use of technology?

I think Curefoods is significantly ahead of most cloud kitchen players in the market due to the various technology tools used, as I have mentioned. We have built an end-to-end technology right from the farm to folk and from the kitchen to the customer, which allows us to make sure our product is of high quality and that we can deliver it across all the kitchens in less than 30 minutes. This gives us a massive advantage over other players on the market.

Any highlights from the last 2 years? Any tech investments, digital projects, acquisitions etc. that you can talk about?

Yes, there are a couple of important projects that we have been working on.

There is attention to focus on reducing wastage of supply through analytics and data modelling, which considers various parameters. This is a massive area of investment for us. We are also focusing on using social media and SEO for the brand to drive direct traffic to our platform. While this activity sounds insignificant, it has required a lot of work and energy from the team and has been one of the critical areas for us. Over 20-25 per cent of our demand now comes from our channels, which is a decent benchmark.

Has technology played any role in portfolio optimization or in ironing out the integration part of the Maverix handshake?

Yes. Both Maverix and EatFit, which are housed under Curefoods, were significantly ahead in the technology curve. The transition required vast migration and the merging of technologies. This has resulted in much more sophisticated and advanced platforms. Today I can say this securely for most of the technology-enabled F&B players in the country.

> Right now, our objective is to have more robotic arms, which can take away the menial job of simple mechanical actions.
>
> **Ankit Nagori, Founder, Curefoods**

What can the industry learn from glitches like the ones recently seen at Starbucks, DoorDash, Grubhub etc. - and from DoorDash's shut-down of Chowbotics?

The industry will face glitches now and then. But the fact that brands like Curefoods are dependent on other platforms like Google Cloud, AWS and others for selling, we need to have our backups of technology and cloud in place. There can be days where there is a total outage across platforms, but fortunately, we have not had such an experience till now.

Any changes or lessons from the recent debate around food delivery apps, pricing regulations etc. in India?

There will always be healthy competition between food platforms like Swiggy, Zomato and our channels. For us, it is a very symbiotic relationship, where we try to ensure that unique features exist on our channels like on Eatfit.in. We also sell on a subscription basis, but a bulk of single on-demand sales also come to us from Swiggy and Zomato.

The fact that we are able to sell subscription-based orders is a testimony to the fact that we've built superior technology which allows us to serve thousands of customers.

What next would be exciting to watch on your tech roadmap? How attractive are technologies like robotic chefs, AR/VR, Drones etc.

We will focus on building technology for middle-mile deliveries where food from the central kitchen can be sent to far-off cloud kitchens. We will also continue to look at the integration of robotics in our kitchens. Right now, our objective is to have more robotic arms, which can take away the menial job of simple mechanical actions. Curefoods will continue investing in Robotics. ■

Get started on your Zero Trust journey

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Every enterprise is different and will have their own unique Zero Trust journey. From our own experience, we have outlined some best practices, which we believe will be helpful for making an enterprise's journey on the Zero Trust highway to be extremely effective

n the past two years, the concept of a perimeter has been completely eliminated. With remote working being the norm than the exception, the traditional security model is no longer effective. This is especially more relevant today, as there is a significant rise in digital transactions. With more users transacting online, the attack surface area has dramatically exploded, with more users accessing applications from different endpoints. This changed landscape has created many issues, with respect to security. The clear need of the hour is to create a stronger security landscape and reduce risks. This is where a Zero Trust framework can help.

Unlike the traditional security model, which assumes that once given access, the identity can be trusted, a Zero Trust model assumes that every entity is hostile, and needs to verify credentials for every transaction. This model demands that trust is verified at each stage before granting any access. And identity is the foundation of this verification process. 'Never trust and always verify' is the core premise of a Zero Trust framework, and this means every entity – a device, a user or any transaction must always verify its credentials before given any access.

## Fundamentals of a zero trust approach

At its core, identity lies at the core of a Zero Trust approach. Enterprises can use a number of techniques to ensure secure access. First and foremost, it is important to create a single source of truth and use federated identities / SSO. This is important as most enterprises have identities scattered all over their ecosystem. Federated identity enables employees, partners, and contractors to work across enterprises without any need to create new identities in each enterprise. SSO (single sign-on) enables users to access different applications within an enterprise using a single identity. Users log on once to an ID provider portal or their company portal and seamlessly connect to other authorized applications. The security can be reinforced using multi-factor authentication. The use of multi-factor authentication (MFA) drastically reduces the chance of account compromise.

RISHIKESH KAMAT, Product Head - Managed Security & IMS - NTT Global Data Centers and Cloud Infrastructure, India

MFA also opens the door for conditional access policy implementation. Enterprises can restrict access to critical applications such as sales or finance to only a select group of people. This restriction could completely deny or allow limited access.

Identity security can be further strengthened using a Privileged Account Management (PAM) Solution. Privileged Accounts (e.g., super admins, service accounts) have too much power. They have elevated privileges that can bypass usual security measures to do things such as granting access to other users, add/delete data/files, system maintenance, running the application or batch jobs, accessing critical enterprise data, etc. As seen in many supply chain attacks, adversaries try to get into the network and get access to privileged accounts through their lateral movements. A Privileged Account Management Solution can be used to manage and monitor privileged accounts. Similarly, organizations can implement a just-in-time access process to privileged accounts to grant access only for the needed time period. Modern PAM tools also include credential vaulting: super admins do not need to know their passwords. Service accounts directly connect to the PAM tool to authenticate before running any
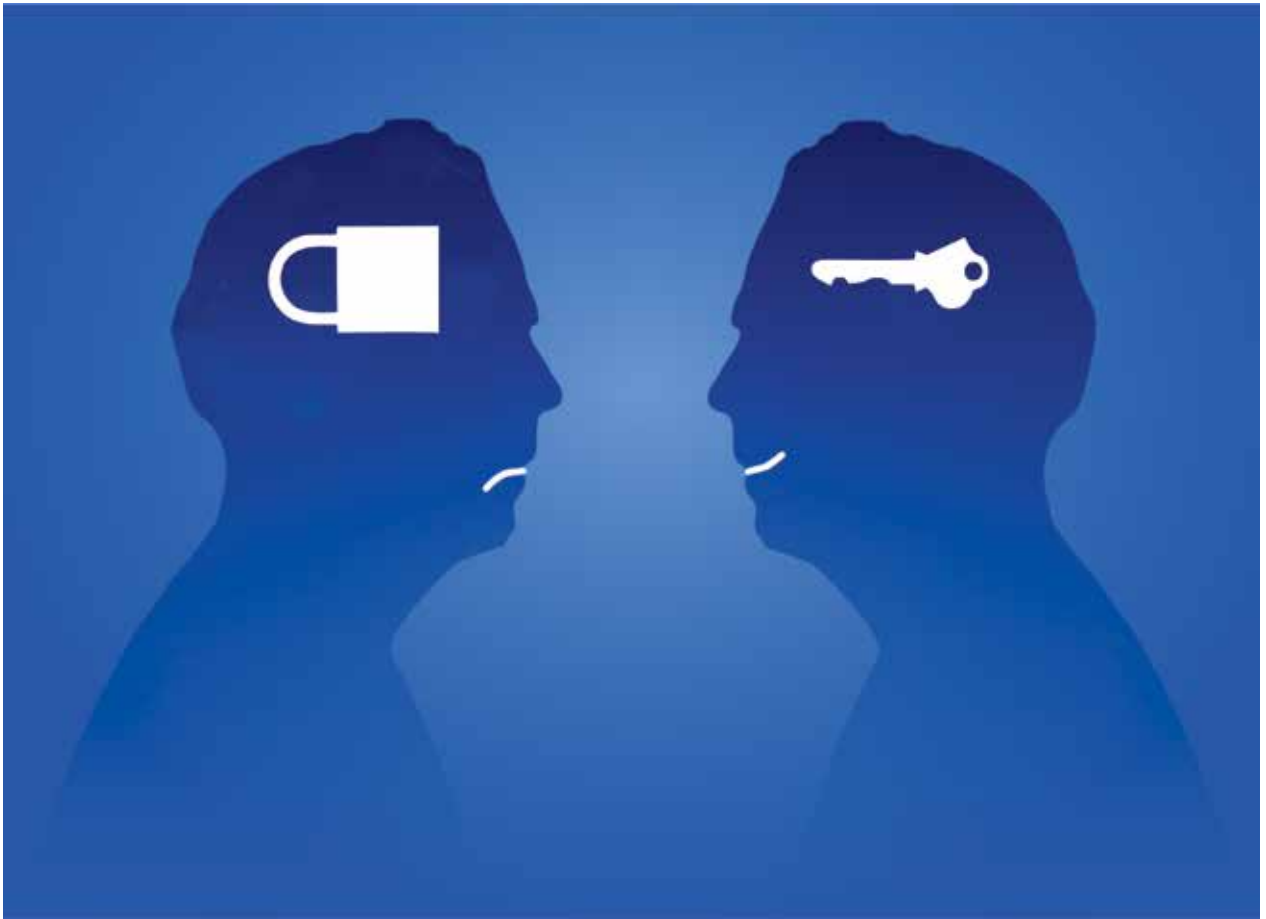
application or batch job.

While identity is extremely important, Zero Trust is not simply about identity and access management from the perimeter. Network security is still critical for providing defense in depth. To achieve this objective, enterprises must install next-generation firewalls (NGFWs) to take advantage of device filtering, deep packet inspection, and other capabilities. Enterprises must also use extensive vulnerability scanning to ensure all OS and application patches are installed and effective. Finally, all security systems must provide inputs to feed the SIEM (Security Information and Event Management) / UEBA solution to ensure real-time entity behavior analytics, anomalous activity identification, and automated workflows and case management to reduce time to respond.

▼ Organizations can implement a just-in-time access process to privileged accounts to grant access only for the needed time period.

Enterprises must remember that there may not be a single vendor which offers a complete Zero Trust security solution. Some Zero Trust security vendors may focus on network access whilesome may focus on identity and access management. Some may offer Zero Trust data protection, while some may focus on fulfilling the role of an Enterprise Threat Protector. Depending on their need, enterprises may choose to select specific Zero Trust providers. ∎

The author is Product Head - Managed Security & IMS - NTT Global Data Centers and Cloud Infrastructure, India

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JABRA
PANACAST 20

WEBCAM

Price: ₹ **41,307**

In the past couple of years, we have witnessed numerous intelligent products – audio, watch, etc. However, the webcam is still the same, low quality. Jabra revolutionised the space with its new intelligent AI-enabled Panacast 20. The first consumer-focused webcam from Jabra is significantly more affordable than the conference room-focused other PanaCast devices.

▼ Build and features

The PanaCast 20 looks like a pillbox that feels solid and is made out of metal. This is the first webcam that comes with a unique design and metal casing that also works as a heat sink for the camera. It holds a 4k lens and microphone pinholes on the left and right. There is another pinhole for the third mic on the top of the textured chassis. It comes with a small sliding switch on the bottom edge that works as a privacy cover. The webcam comes with a USB-C port that faces down on the bottom panel, near the back.

The flat design camera has a monitor clip,

a square metal arm that flips down from the bottom of the chassis. The metal clip lets you fix the webcam on any screen, however, the arm doesn't rotate farther back and the front lip is fairly shallow and wide, so the webcam feels less stable on thicker monitors.

PanaCast 20 comes with a zip-up case that securely holds the webcam and the USB cable

Overall: **8/10**

SCORE
PRICE: **6**/10
PERFORMANCE: **9**/10
FEATURES: **8**/10

KEY SPECS
AI-powered 4K Ultra-HD video; Intelligent Zoom; Intelligent Lighting Optimisation; Intuitive Picture-in-Picture mode

PROS:
Solid build; Wide-angle 4K camera; Face tracking; MEMS Microphones; Privacy shutters

CONS:
Expensive

which is fairly long around 1 meter.

▼ Features

Jabra PanaCast 20 webcam has a 13MP, 1/3.2-inch sensor and a 117-degree, f/2.25 lens. It relies on three MEMS microphones for audio capture. The USB Type C cable plays a dual role – powering up the device and data transfer. The single cable draws the power from a USB 3 or USB 2 port plus captures the video and audio. The Jabra Direct software is available for macOS and Windows, you can easily install the software on your PC and the device as per your preferences. The software lets you choose auto to manual zoom and framing features. It also lets you update its firmware. The app is quite intuitive to use and designed for multipurpose that works with most Jabra devices.

However, despite a live preview feature, you can't use the software to record or stream

able to utilise the resolution. The typical video calling apps support up to 1080p. The camera lets you adjust the field of view and the Intelligent Zoom feature digitally crops in up to 3x, offering a minimum 720p resolution. The camera automatically tracks your face, keeping you in the frame. The camera has a fairly wide sight range that keeps you always on spot. You can also manually control the camera in the Jabra Direct app for any pan, tilt, or zoom controls in your software of choice to manually frame your shots.

▼ Performance

The 4K camera captures reasonably sharp images and videos with good lighting. While using the 4k, it captures plenty of detail, however, moderate noise appears. Although, in the well-lit environment, we didn't notice any noise. The Intelligent Zoom feature works fairly well, however, if you are using the webcam in a large room or with multiple objects, it can gets confused a bit and takes a few moments to zoom in, but after that, it cropped and panned the frame smoothly and slowly.

The three mics work perfectly fine, it was able to reduce noise and capture my voice. However, it wasn't particularly clean and was a bit fuzzy when tested in a small room. While using the PanaCast in a hall, we noticed a bit of echo, using the mic setting we were able to reduce the echo.. ▪

anything from the camera. It's mostly just for keeping the camera up to date, toggling the Intelligent Zoom feature, setting the field of view, and tweaking the exposure and white balance settings before you use the camera with dedicated video conferencing, recording, or streaming software.

Though you get a 4k webcam, you won't be

Bottomline: The Jabra PanaCast 20 webcam is good enough to attend any video call/meeting/conference as it can reduce the noise and automatically focuses on you. Though you won't be able to use 4k resolution with most of the meeting apps yet it will capture clean video. Overall it's a perfect device for handling video calls for just one person or an entire conference room, but available at a higher price point.

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