



5G AND THE EVOLUTION OF TECHNOLOGY

Telecommunication companies are the front-runners in the dynamic cycle of 5G development. This technology is dramatically reshaping the world. Earlier network generations were more like upgrades, while 5G has the potential to accelerate the Fourth Industrial Revolution. This paper covers 5G impact and opportunities.



5G and the evolution of technology

Telecom companies are the pioneers of the Fourth Industrial Revolution. Thanks to telcos, 5G¹ will reach the consumer with better devices and latency, VR/AR technology, Internet of Things (IoT), and other innovations. However, some telcos themselves are at the risk of suffering the most from this revolution as they will face more challenges in their struggle to survive. Meanwhile, other telcos are looking for

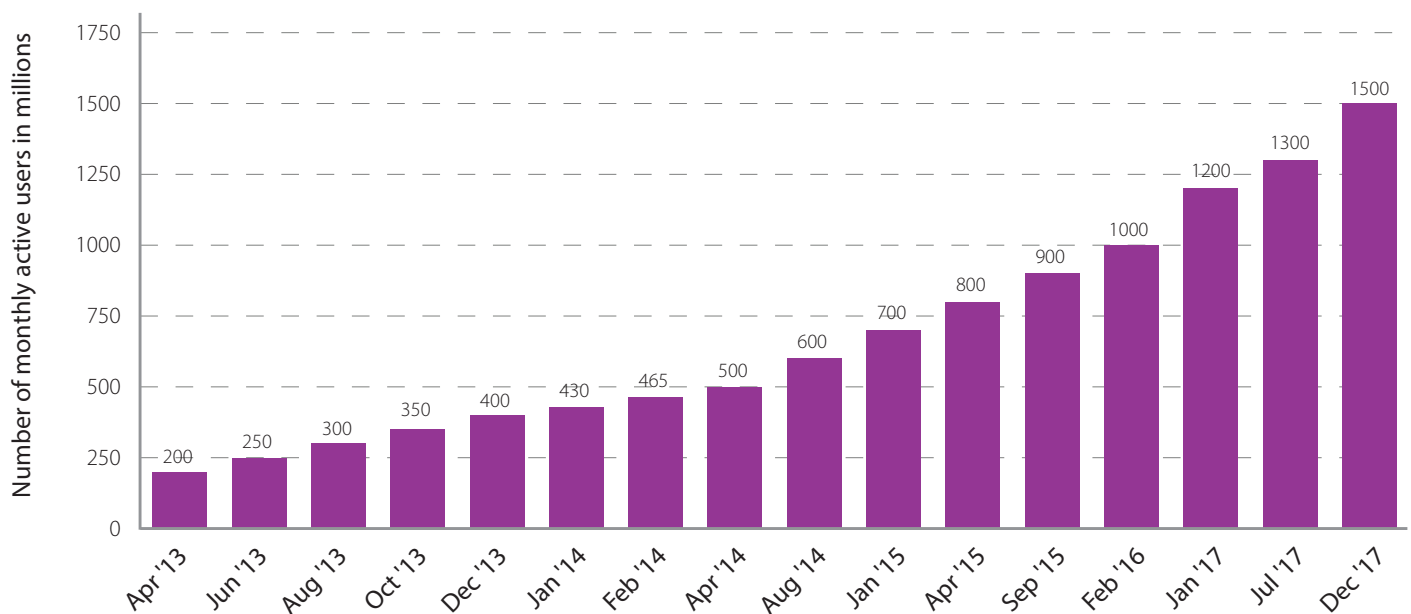
5G to raise their game, seeing it as an open platform that will allow deeper industry collaboration. New trends in software and technology pose critical challenges yet phenomenal opportunities for all industries.

The focus is shifting from standard cellular network to web-based communication. More and more clients are shifting to free web-based national and international

communication via services provided by Viber, Facebook Messenger, and WeChat. However, the most dramatic example may be WhatsApp, which has experienced phenomenal growth since 2013, from 200 million active monthly users to an eye-popping 1.5 billion (Figure 1).

5G high-speed internet may eliminate the need for the classic cellular-connected network. Web-based communication companies became cost-competitive in the age of 4G and are expected to gain a further boost through the 5G network. Yet web-based communication companies will have to adapt to AR/VR/IoT technologies, which will bring additional challenges.

Fig 1. Steady growth of monthly active WhatsApp users (2013-2017)



Source: WhatsApp; Facebook

Essential breakthrough

There will be widespread consumption and adoption of 5G, but that's only one part of the story. 5G technology is expected to enable a consequential revolution in devices to fully reach the projected level of the Fourth Industrial

Revolution. A modern smartphone is not an effective vehicle to achieve 5G's maximum potential. While mobile consumption in its current form is not going to change much, new interconnected devices and

equipment will indeed revolutionize communication and dramatically enhance 5G technology utilization. This will enhance societal productivity and efficiency, with 5G fundamentally changing the way people live and work.

Monetizing 5G

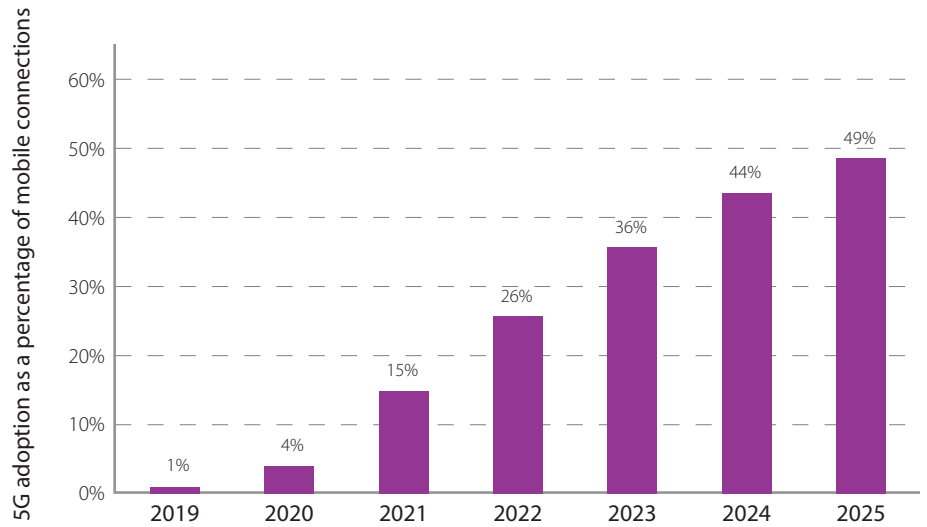
Expectations: Current telcos will invest many billions in infrastructure development, and further adaptation (Figure 2) will drive even more investment in infrastructure. However, telcos across the board will face the existential challenge - how to monetize 5G and avoid going broke while paving the next-generation information superhighway.

During the next two years, the tech world will be looking for answers to questions about what 5G means for technologies and how to improve revenues - not losing out to the OTTs/software² companies.

From the Infosys point of view, 5G provides multiple techniques to make a network better and faster. Many operators are focusing their long-term strategy on 5G development. As it is fundamentally different from a 4G network, 5G will also significantly reduce the consumption of CDMA (Figure 3), GSM, and other types of cellphone networks. Hardware will play an even smaller part in revenue generation, and 5G subscriptions will need to become a substantial secondary profit driver. For example, the rapid growth and monetization of WhatsApp became possible thanks to the 3G and 4G networks.

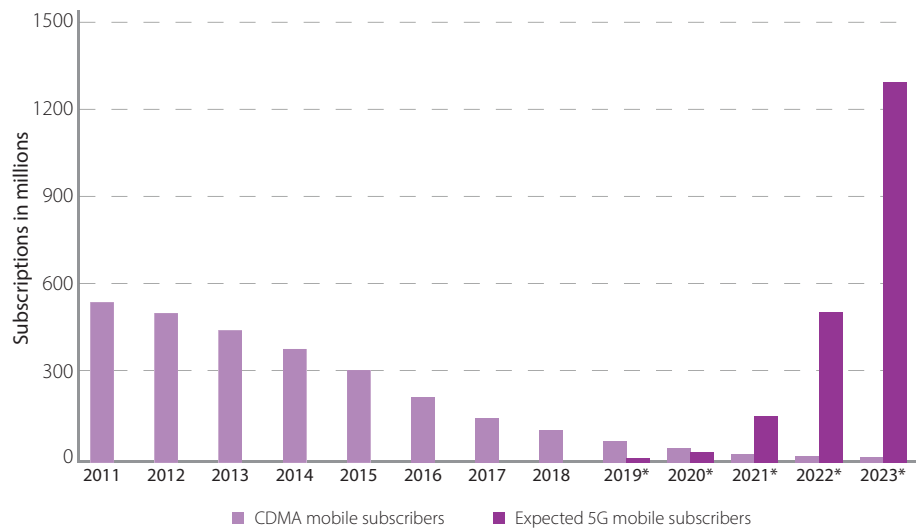
5G creates new monetization opportunities for the entire telecom ecosystem (Figure 3). Wide access to high-speed wireless data creates opportunities previously unseen for content and software creation companies. However, this wide access presents a significant problem for incumbent telcos such as Verizon, Vodafone, T-Mobile, as they may not be ready for software-based markets. Telecom giants expect their partners to offer 5G solutions on both hardware and software, as well as on 5G monetization.

Fig 2. Forecasted exponential growth of 5G adoption (North America, 2019-2025)



Source: GSMA

Fig 3. Expected mobile subscriptions of 5G will far surpass that of CDMA (worldwide, 2011-2023)



Source: Ericsson

*Estimates

Solutions: In simple terms, 5G is more software-based and more cloud-native than the preceding technologies. Technology-related shortcomings are pushing software-oriented companies to adopt new 5G-related technologies by acquiring start-ups and established companies with software skills and cloud, VR/AR, and AI expertise. Partners will compete to take major roles in 5G deployment, offering technology expertise in automation, onboarding, AI technologies, VR/AR, and other software. The technology is still in its early days and the solutions are still in development.

Opportunities: It is predicted that 5G networks will develop and accelerate adoption for M2M (machine-to-machine) interaction models. The new network will reduce energy consumption, increase

interaction with devices, and accelerate development of completely new services such as AI-controlled airborne vehicles and drones.

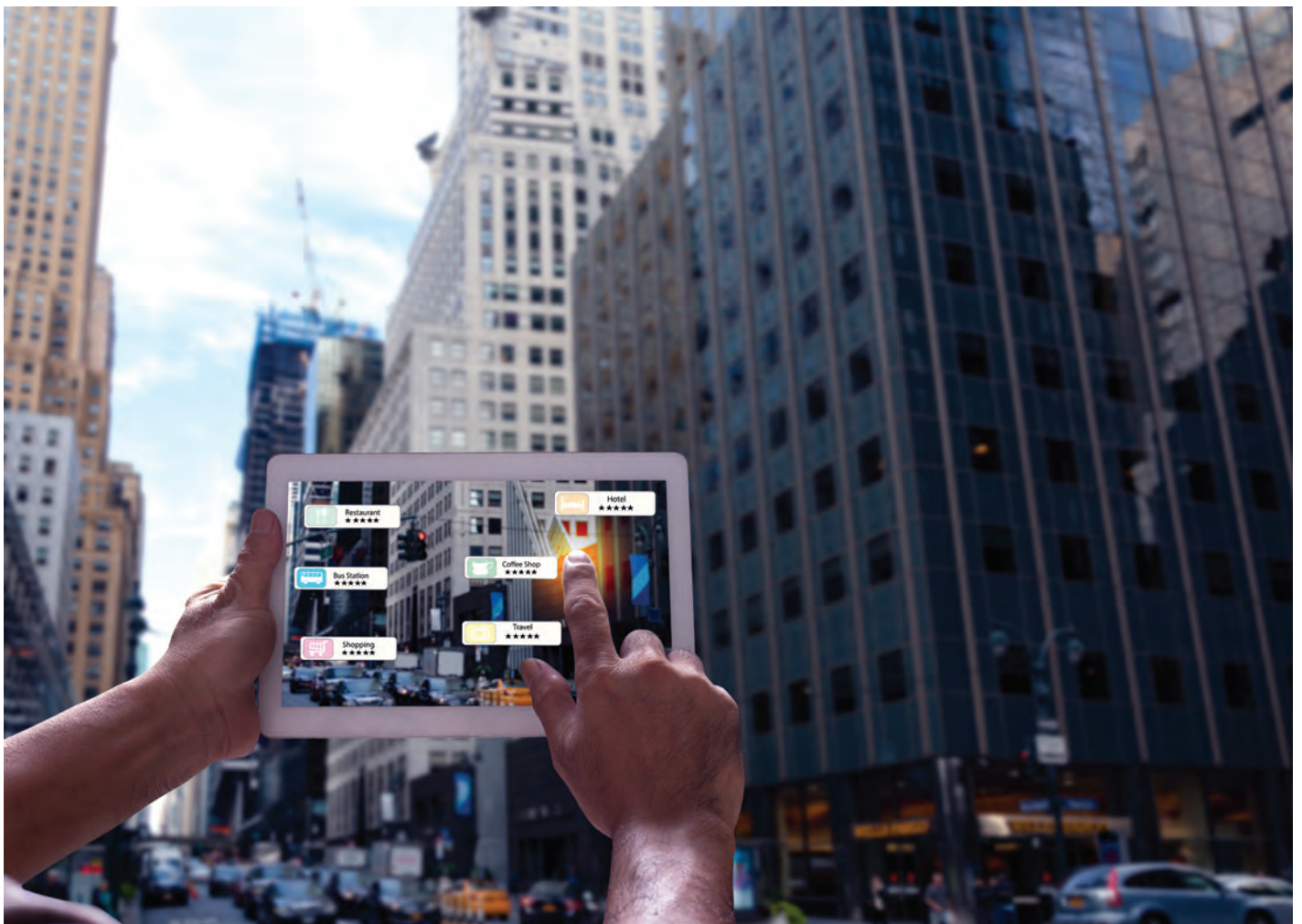
5G will also enable organization of 'smart' movements throughout smart cities via innovations like self-driving cars and AI-controlled robots. VR and AR will enable remote health care on a new level. Precision farming and remote VR/AR-based education are two cutting-edge opportunities that cause experts to believe that 5G has legitimate potential to change the world.

Latency and speed

Low latency and ultra-high speed will increase content consumption. Today high-speed data transfer enables quick streaming of heavy video content in

8K, VR, or AR across devices as well as many other applications. AR will change our user experience in travel, shopping, acquisition of any service, content consumption, and leisure time (see picture below).

Almost any process that can be performed in the real world can be replicated in VR. As a result, the early companies that will be able to produce a new, compelling generation of AR/VR content and software will benefit the most from 5G³. For example, Google has already implemented AR maps⁴, which gives a hint about how the 5G world may look. However, the experience will feel complete once AR technology becomes fully integrated into wearables such as standard eyeglasses and contact lenses.



Transition and network slicing

While 5G is still in development, telcos are thinking about the imminent transition. A highly flexible network is required to successfully transition from 4G to 5G. Network flexibility is provided by network slicing, which breaks one physical network into several layers, each of which has its own settings adapted to a specific service. This helps reduce expenses while providing efficiency and flexibility. Logically separated segments and isolated systems with different architectures may be used (open) or not (closed), while operators are able to use common functional components.

Network slicing reduces the business risks associated with launching new services because problems in one segment do not affect the functioning of services in another segment. In addition, the use of segmentation reduces issues in migration. A flexible core network with integrated network slicing increases the value of other networks built on a common infrastructure.

In a recent pilot, Infosys used automation in slice design and management, bridging TMF and GSMA standards, leveraging Open Network Automation Platform (ONAP) and OSM for V2X digital bundle for Ultra Reliable Low Latency Communications (URLLC) slice⁵. While this is literally an alphabet soup of telco terms, it showed that even in these early days, network slicing works and can even be automated to reduce cost, improve speed, and meet existing standards.

5G introduces the network slicing concept through the following three services⁶:

- **Enhanced Mobile Broad Band (eMBB):** Enables extreme capacity, enhanced data rates/spectral efficiency, extended coverage, and deep awareness.
- **Ultra Reliable Low Latency Communications (URLLC):** Supports ultra-high reliability, ultra-low latency, strong security, and extreme user mobility.
- **Massive Machine Type Communications or Massive Internet of Things (mMTC/mIoT):** Supports ultra-high density, ultra-low energy, ultra-low complexity, and deep coverage.

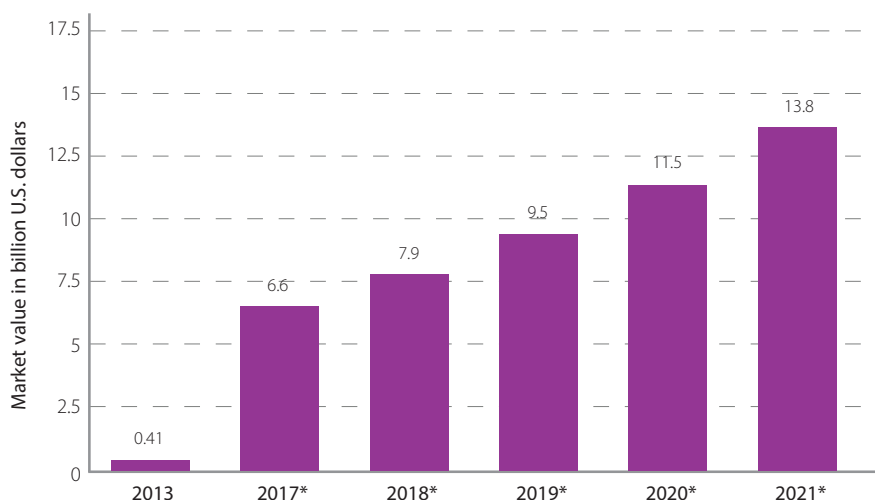
These use cases are expected to generate sizable monetization opportunities and experiences:

- V2X, autonomous driving, vehicle maintenance, enterprise (B2B, B2B2X business models), consumer services
- Immersive entertainment (live streaming, AR/VR solutions)
- Connected stadium (fan experience)
- Industrial automation, remote monitoring, IoT platforms, streaming with AR/VR for remote assistance and guidance
- Smart health, smart cities, smart homes
- Drones-as-a-Service (surveillance, 5G signal QoS assessment)

Governments and hyper-connected world

Facebook has been around nearly a decade and a half, yet governments are still grappling to understand what it really is. 5G will become an additional long-term technology comprehension process for governments around the world. Regulations will lag as technology develops and business processes evolve rapidly (Figure 4). For instance, self-driving cars and flying drones already exist, and if the hype is to be believed, they will displace many incumbent technologies. However, governments have still not developed proper laws and guidelines for these technologies.

Fig 4. Software-defined networking market value is expected to grow thirty three times from 2013 (worldwide, 2013-2021)



Source: IDC; Statista estimates; IDG Research Services (NetworkWorld)

*Estimates

5G will provide a short-term advantage to telcos, which may benefit from a new, less-regulated ecosystem. Emerging technologies may remain perplexing to governments for a decade or more before regulations are deliberated and properly implemented. For example, the U.S. government still does not quite know how to regulate Google,

which collects, resells, and stores data about billions of users all over the world. People may share more secrets with Google than they do with their closest family members - often without recognizing that they are sharing private information with the technology company whose business is to sell the collected data through Google AdWords and other

similar services. Therefore, it may take some time until the government fully comprehends the regulatory and tax revenue considerations provided by 5G and related technologies. This gap will allow telcos to improve their presence, quickly deploy larger numbers of 5G towers, and establish a competitive advantage.

How technology can move from lab to life

5G technology-focused companies are preparing to adapt to this new environment, focusing their efforts on getting 5G technology to work and not on contextualizing it to solve business problems. Noticing this gap, Infosys introduced Living Labs, which contextualizes emerging technologies to business problems and opportunities. Living Labs is a program led by the Infosys Center for Emerging Technology Solutions (iCETS) and Brilliant Basics, a London-based design agency (Infosys subsidiary). The team uses design thinking, technology, and an innovation ecosystem to incubate ideas and then guide toward deployment at scale. This combination of design sprint and use case immersion is the emerging model

to increase business value from 5G technology and identify monetization opportunities. The intention is to help telcos, equipment manufacturers, and software developers collaborate to create 5G efficient infrastructure, devices, and software.

We believe 5G will drive the Fourth Industrial Revolution. But what does it mean to the consumer with regard to consumption? Technical performance improvements such as 100x faster speed and much-improved latency are expected, and a great start. But the transformation of consumption norms is still a challenge. Eventually, 5G is going to enable the technology and network to evolve across the consumer life cycle.

Technology may provide the spark, but governance and cultural change will also be required to create the revolutions in industries like education, health care, and transportation. Wireless networks are becoming virtualized, and that's changing the economics of mobile networks completely, helping telcos move toward an open, cost-effective, and flexible 5G network ecosystem. Forward-thinking telcos can improve the success of their 5G networking strategy through selection of technology partners with deep product software development expertise.

References

¹ 5G means fifth generation of mobile network. 5G is expected to reach speeds of 20 Gbps and higher with very low milliseconds latency.

² "An over-the-top (OTT) application is any app or service that provides a product over the internet and bypasses traditional distribution." (www.techopedia.com)

³ <https://5g.co.uk/guides/5g-virtual-reality-and-augmented-reality/>

⁴ <https://techcrunch.com/2019/02/11/hands-on-with-an-alpha-build-of-google-maps-augmented-reality-mode/>

⁵ <https://www.automotiveworld.com/news-releases/infosys-wins-outstanding-catalyst-award-in-innovation-for-5g-patisserie/>

⁶ <https://www.infosys.com/insights/digital-future/Pages/monetization-in-5g.aspx>

Author

Raja Shah

Senior Vice President – Communications, Media and Entertainment

Raja_MS@infosys.com

About Infosys Knowledge Institute

The Infosys Knowledge Institute helps industry leaders develop a deeper understanding of business and technology trends through compelling thought leadership. Our researchers and subject matter experts provide a fact base that aids decision making on critical business and technology issues.

To view our research, visit Infosys Knowledge Institute at infosys.com/IKI

For more information, contact askus@infosys.com



© 2019 Infosys Limited, Bengaluru, India. All Rights Reserved. Infosys believes the information in this document is accurate as of its publication date; such information is subject to change without notice. Infosys acknowledges the proprietary rights of other companies to the trademarks, product names and such other intellectual property rights mentioned in this document. Except as expressly permitted, neither this documentation nor any part of it may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, printing, photocopying, recording or otherwise, without the prior permission of Infosys Limited and/ or any named intellectual property rights holders under this document.