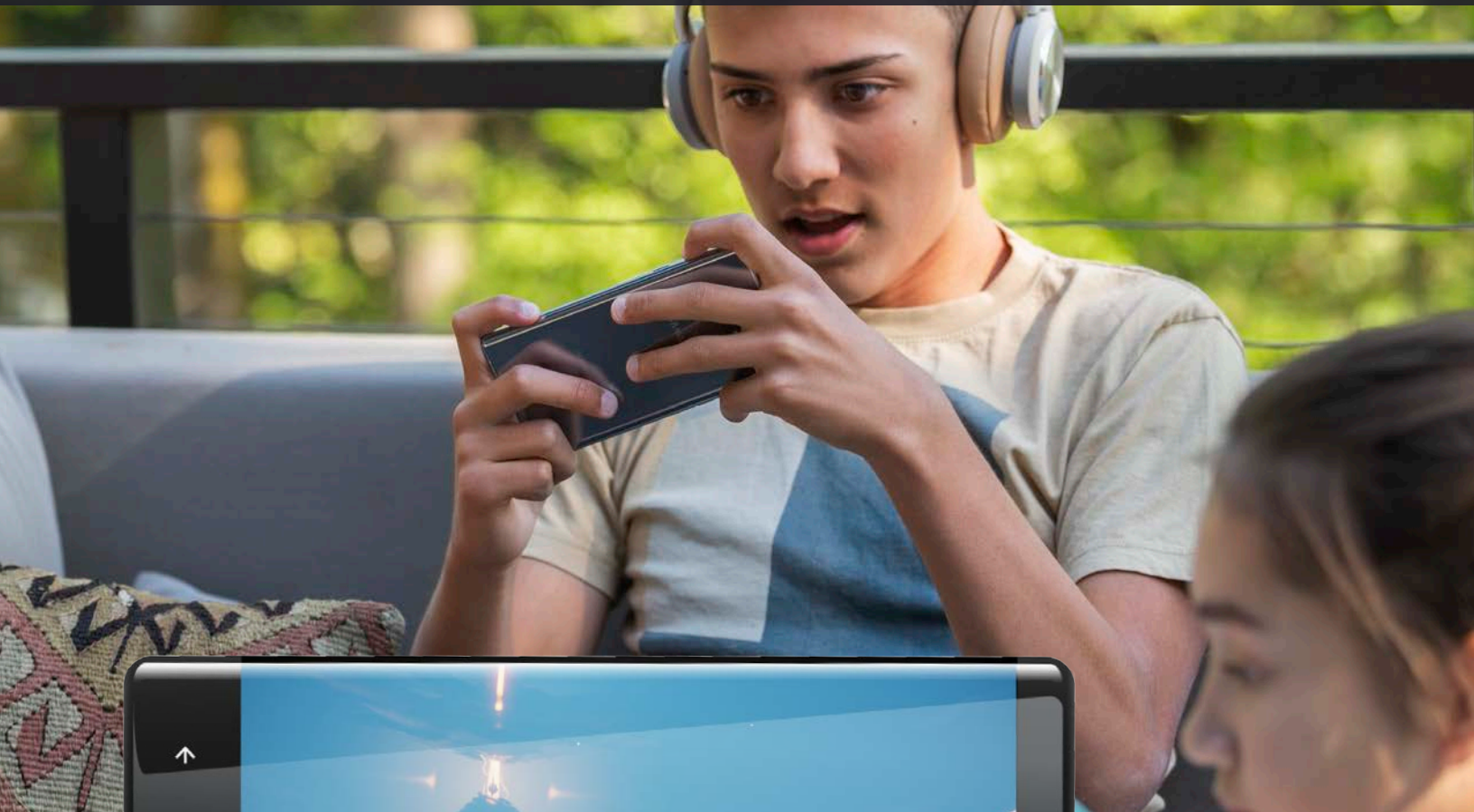


INTERNATIONAL
MOBILE GAMING AWARDS

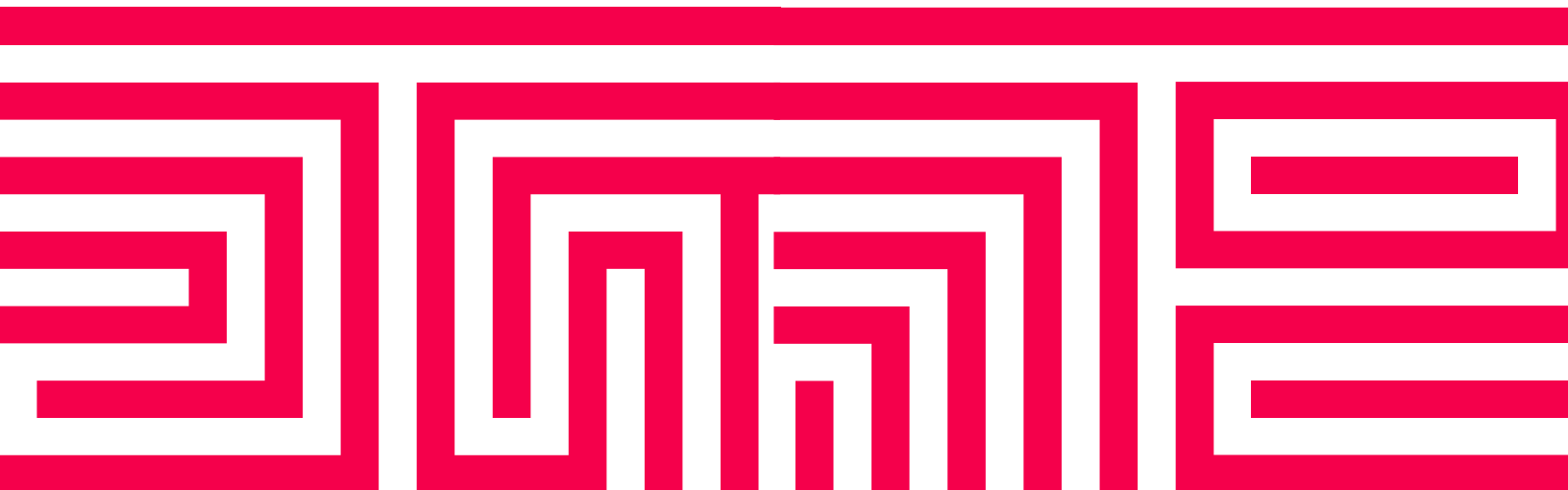


THE 5G FUTURE OF
MOBILE GAMES

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Qualcomm
Technologies, Inc.

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INTRODUCTION

Since 1997, its early beginnings in Helsinki, Finland, where the game **Snake** was made, the mobile gaming industry has known massive deadlocks and impressive leaps forward. Today, the industry is characterized by exponential growth, has made many entrepreneurs multi-millionaires and provides jobs to a fast growing¹ number of artists, programmers, marketeers, testers and entrepreneurs worldwide.

The future looks bright: today one third of the world population plays mobile games regularly and together they are expected to spend US\$ 159.3 Billion on games in 2020. US\$ 77.2 Billion will be spent on mobile and tablet games² only. The industry has one of the most dynamic job markets worldwide and is growing all over the world, even in emerging economies in South America, the Middle East and Africa.

In the second quarter of 2020 I have asked several mobile games business leaders in the USA, Europe and Asia what will be the most important, game-changing new technology for the near future. They all mentioned 5G as the most promising innovation. Many developers see 5G as a foundational technology, bringing innovation in a wide range of fields; Cloud Gaming, multiplayer games, mobile eSports, AR, VR and Mixed Reality (MR) to name a few.

Next to these insights, we present expert information about what 5G is, technically, and when and where it is expected to roll out worldwide; the 5G networks and the 5G-enabled handsets. We will provide links to more detailed and technical information for the experts, provided by Qualcomm Technologies, Inc. and their partners.

The expected economic impact of 5G, in terms of new jobs and value created, is also detailed.

If you want to get ready for the 5G future of mobile games, reading this white paper is a good start.



MAARTEN NOYONS

Founder of the International Mobile Gaming Awards

¹ <https://www.ibisworld.com/industry-statistics/employment/video-games-united-states/>

² <https://newzoo.com/insights/trend-reports/>

WHAT IS 5G?

5G is the 5th generation of mobile network technology. It is a new global wireless standard after 1G, 2G, 3G and 4G networks. 5G is meant to deliver higher multi-Gbps peak data speeds, ultra-low latency, more reliability, massive network capacity, increased availability and a more uniform user experience to more users. Higher performance and improved efficiency empower new user experiences and connects new industries.

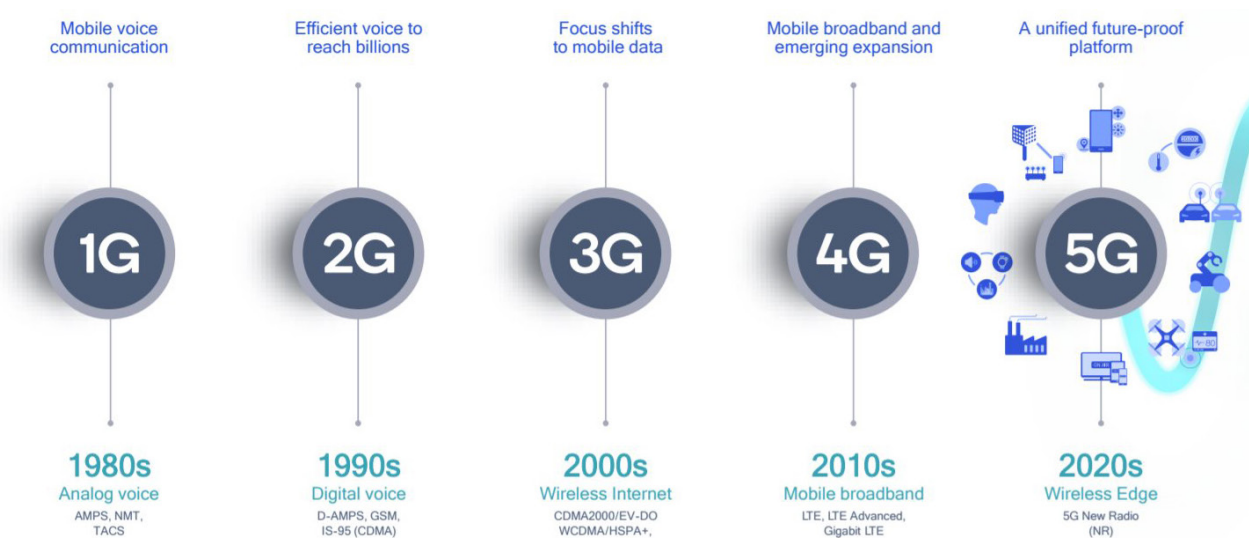
With high speeds, superior reliability and negligible latency, 5G is designed to expand the mobile ecosystem into new realms. 5G is expected to impact nearly every industry, supporting a wide range of industries and potentially enabling up to US\$ 13.2 Trillion of global sales activity by 2035⁴.

For the mobile gaming industry, 5G means a faster, more reliable and responsive connection to the internet and cloud services. 5G is designed to deliver peak data rates up to 20 Gbps based on IMT-2020 requirements. But 5G is about more than just how fast it is. In addition to higher peak data rates, 5G is designed to provide much more network capacity by expanding into new spectrums, such as mmWave.

5G can also deliver much lower latency for a more immediate response and can provide an overall more uniform user experience so that the data rates stay consistently high, even when users are moving around.

5G is also one of the most rapidly adopted technologies at a global scale. At the time of this writing, little more than a year since the launch of the first commercial 5G network and phone, there are more than 130 commercial 5G networks in about 60 countries. Nearly every major phone manufacturer has launched several 5G device models – with prices as low as US\$ 250. In China, more than 60% of new mobile phone sales is 5G.

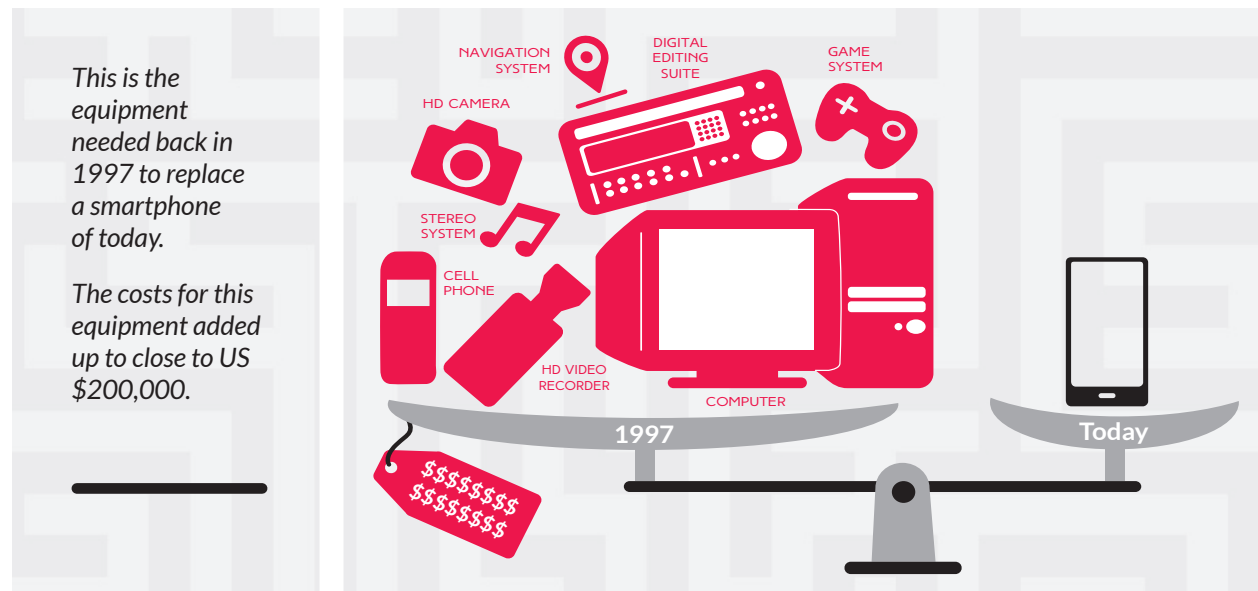
In addition to smartphones, 5G mobile technology is expected to usher in new, immersive experiences in other device categories including 5G PCs, virtual reality headsets, augmented reality glasses, in-vehicle infotainment systems and more.



⁴ <https://www.qualcomm.com/documents/ihs-5g-economic-impact-study-2019>

THE EVOLUTION OF NETWORKS AND HANDSETS

How did we build this US\$ 77.2 Billion market for mobile games?



Think about the engineers, the industrial designers, the entrepreneurs and investors who built the smartphone technology and the network technology that made all this possible. Think about the first mobile games companies in 1999 and 2000 and their designers and programmers who worked with all the limitations of the phones and networks back then, as well as a non-existing market, at least in the USA and Europe.

They shared a dream of achieving something amazing: everybody being able to play great games anytime, everywhere. And that's what we see right now.

"Games are a form of art, not a science.", said Ilkka Paananen, co-founder and CEO of Supercell⁵.

But it is also an ingenious digital creation, which contains great graphics, a lot of interactivity and a complete set of digital tools which allows the game to work on different devices, to store user data, to allow secure transactions and much more.

Games are a business too. And the mobile games business grows when all the stakeholders can play their part and receive a fair share for their efforts: the technology providers, the network operators, the handset manufacturers, the platform owners and operators, the game makers and publishers.

In the first 10 years of mobile games Japan and Korea showed how mobile network operators, handset manufacturers and game makers could create a profitable business for mobile games, which the Korean and Japanese players loved. NTT Docomo, for instance, created a content delivery platform called i-mode, which guaranteed fast and secure delivery of a whole range of different content, including games. The content owners received 85% of the revenues NTT Docomo charged consumers and similar models existed in Korea with SK Telecom and KT. This model worked and very quickly the two countries generated about 70% of the worldwide market for mobile games.

In Europe and North America, the situation was quite different. Mobile network operators preferred to work with a limited number of big publishers and took between 50-60% of what they charged for the mobile games. A small or unknown developer had to work with a publisher and share revenues with that publisher, which meant that he or she was left with less than 25% of the gross revenues, while all the costs were borne by the developer.

⁵ <https://www.wired.co.uk/article/ilkka-paananen>



And these costs were quite high: the phones ran different software, had different hardware, screen sizes, etc. and every local network operator had different rules. This meant that a developer who wanted to address a large market had to build hundreds of different versions of the same game. Michel Guillemot, the CEO and co-founder of Gameloft said at a conference in 2005 that Gameloft was delivering up to a thousand different versions (SKU's) of a game.

Up until the launch of the App Store, consumers could not download the games they bought directly to their phones. The operators were controlling what could run on 'their' networks and 'their' phones.

This was all disrupted fundamentally in 2009 with Apple's App Store and the Android Market, now Google Play. Very quickly the market surged, because now developers had a platform which gave them 70% of the revenues. They had a much larger incentive to invest in quality.

In the meantime, the phones were more powerful, the tools for making games were better and a lot of artists, programmers and game designers moved from other platforms to mobile.

The last 10-15 years the app stores grew fast, offering a variety of tools, information services, different forms of entertainment and more. Apple alone earned US\$ 61 Billion from its customers for digital goods and services in 2019, according to a study commissioned by Apple⁶.

There is probably no type of app that uses as many of a smartphone's capabilities as games: there are camera games, drawing games, GPS games, AR games, music games, audio games, games using accelerometers, compasses, texting, voice input and AI.

Mobile game developers are always working on the bleeding edge of what is possible in the current technical environment; the processing power, the new features, the screen resolution and battery power of the latest phones and of course the evolution of the networks.

⁶ <https://www.apple.com/newsroom/pdfs/app-store-study-2019.pdf>

How important is new technology, such as 5G, for a mobile games company?

Kristian Segerstrale is a serial entrepreneur in mobile games since 2001 and is currently the CEO of SuperEvilMegaCorp. The company won many awards with **Vainglory**, including two **IMGAs: Best Technical Achievement** and **Public Choice Award** at the 11th IMGA in 2015. Kristian talks about the relationship between science, technology and art in a games company: “I actually think that the hardest part of building a game company right now is that business and distribution considerations have to be really deeply embedded into the thinking around design and technology, or what’s being built. So, the really important part is to find that intersection, where the design and art-focused people, the people who are creating this experience that hopefully pushes the art forward, are able to really deeply trust and understand the considerations that come from measuring things and the challenges associated with distribution and broader, I guess, business considerations.

And vice-versa, to have folks who own the business and distribution and numbers side who are deeply, deeply empathetic to what the artist, what the designers are trying to do. And I found that it’s really the communication and level of trust between these departments, if you like, all these individual people and leaders.

I think it’s more and more going to be collaborations of people who are experts in different fields, trusting each other’s judgment and finding that intersection, where all of these different types of success criteria end up being successful.”


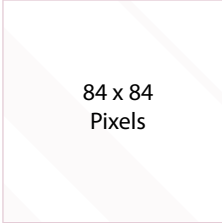






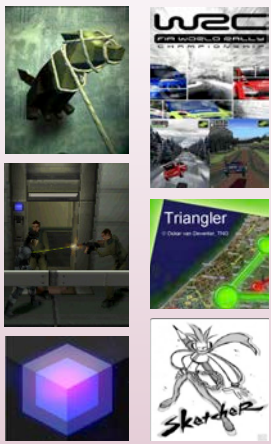
Mobile games consist of many different combinations of these three elements: Art, technology (science) and business. In great games these three ingredients form an exquisite harmony, creating a surprisingly rich experience.

And in great, successful companies these three elements are in balance.



Pictured above is a screenshot from 16th IMGA Grand Prix winner **Sky: Children of the Light**.

THE EVOLUTION OF MOBILE TECH AND GAMES

	Network	Platform	Games
PRE -1999	 2G networks 1995 introduction of GPRS (171Kbps) 1997 intro of EDGE (384Kbps)	Nokia 3310 84 x 84 pixels (Image is actual resolution) 	 B&W games, such as <i>Snake</i> and <i>Tetris</i> , preloaded on mobile phones
2000 - 2001	3G launches first in Japan and Korea (2Mbps) The first camera phone launches in Japan: Sharp's JPhone 	Content delivery platforms are launched: NTT Docomo launches i-mode in Japan. WAP (Wireless Application Protocol) launches in Europe. BREW™ Platform launches in the USA. Mobile phones and WAP (Europe, Japan), BREW (USA, later Korea) and i-Mode (Japan) created the basic ecosystem that would allow developers to make games and sell them over-the-air to willing mobile players.	The first mobile games companies kick off: In Korea: Com2Us, Gamevil, Zio Interactive In the USA: JAMDAT, Sorrent In Europe Ludigames (now Gameloft), Handy Games and MacroSpace. In Japan: G-mode and existing games companies such as TAITO, Bandai Namco. 
2002 - 2005	3G rolls out worldwide. Global revenue in mobile games reaches US\$ 1 Billion, 70% is generated in Asia Pacific. Many manufacturers build phones for gaming, but without success. In 2003 Nokia launches its N-Gage gaming console. The project stops in 2005.	2002 is the year that Java (J2ME) comes to mobile, bringing colour to the screens. The resolution is still poor in 2002: Nokia 3140 (2002) 96 x 64 pixels But resolution gets better and games are getting less pixelized. N-Gage phone (2003) 176 x 208 pixels Motorola Razr V3 (2004) 176 x 220 pixels 	 IMGA launches. Most games are smaller than 1MB. Some companies try to reach worldwide audiences while others are fascinated by the new technical possibilities. We see early experiments with AR (<i>AR Tennis</i> , by HitLab) and location-based games (<i>BotFighters</i> by It's Alive). The biggest grossing game in the world in 2005 was <i>Tetris</i> .
2006 - 2009	Feature phones are being replaced with smartphones all over the world. In 2007 Nokia launches the N-Gage platform which pushes the gaming capabilities of its series 60 smartphones. In 2008 The first iPhone is launched and quickly after that the first Android phones appear. In 2009 Nokia discontinues N-Gage.	With the iPhone, Apple opens the door for side-loading: consumers no longer need to pay the mobile operators for game delivery, they can just download it using iTunes. This changed the market profoundly. The Android Market launches in 2008, which becomes Google Play in 2012. Nokia N95 (2006) 240 x 320 pixels Apple iPhone (2007) 330 x 480 pixels 	 The first large IPs ported to mobile start having a certain success, such as <i>Metal Gear Solid</i> , winner of the IMGA Grand Prix. Some of these games become classics, such as IMGA winners <i>Edge</i> and <i>Zen Bound</i> .

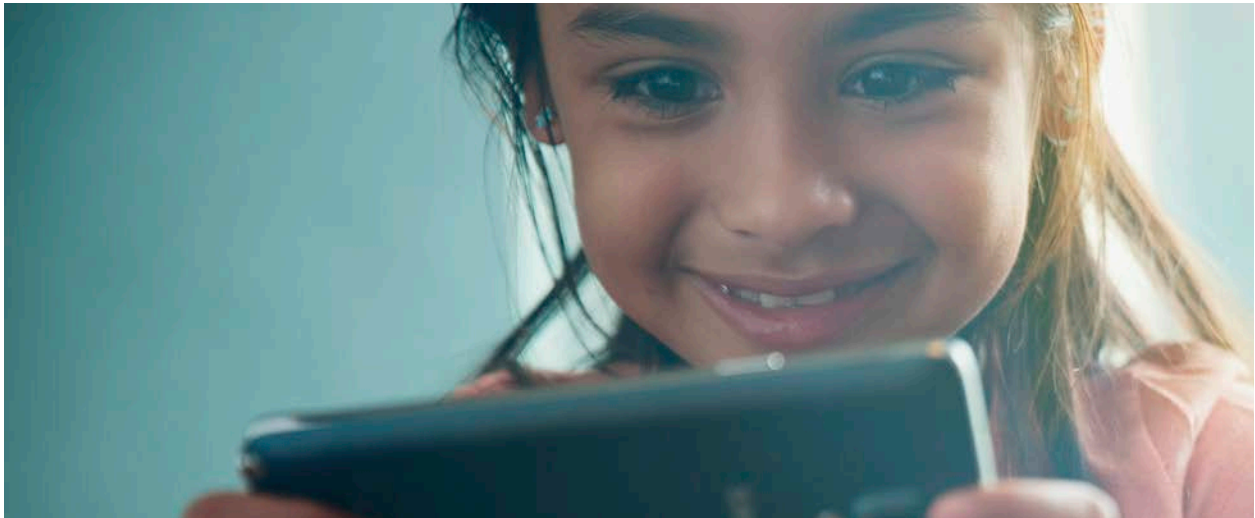
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THE EVOLUTION OF MOBILE TECH AND GAMES

	Network	Platforms	Games
2010 - 2013	<p>4G starts to roll out, first with 4G LTE (50-75 Mbps) and later with LTE Advanced (150+ Mbps).</p>  <p>Android and iOS become the dominant platforms.</p> 	<p>The mobile games industry goes through a fundamental change. An operator-dominated market characterized by the premium games business model rapidly changes into a freemium and ad-based business model, controlled by the platforms.</p> <p>Motorola Droid Razr (2011) 580 x 960 pixels</p>  	 <p>The first mobile worldwide hits launch in this period such as <i>Temple Run</i>, <i>Subway Surfers</i>, <i>Plants vs Zombies</i>, and <i>Angry Birds</i>. Some of them are still in the top 10, such as <i>Clash of Clans</i> and <i>Candy Crush Saga</i>.</p>
2014 - TODAY	<p>The 4G roll out.</p> <p>Today 92.4% of all smartphones are 4G compatible.</p> <p>China rapidly becomes the largest market for mobile games. However, regulations introduced in 2018 makes publishing in China difficult for non-Chinese publishers. It can take more than six months before a game gets its authorization.</p> 	<p>In the last five years the Platform domination is challenged and Amazon, Apple, Microsoft, Sony, Google and a bunch of small companies and start-ups (Hatch, and Gameclub) are trying to build game streaming services at the time that 5G launches worldwide – creating a 'Netflix or Spotify for Games'.</p> <p>It will be difficult to make that service platform independent because of the current fragmentation of consoles (Xbox, PlayStation) and operating systems (iOS, Android). But apparently this is what the industry thinks the consumer wants.</p> <p>We might be on the verge of a new fundamental disruption in the mobile games industry, when a Cloud Gaming company delivers a service as complete and flawless as Netflix or Spotify.</p> <p>Sony Xperia 1 (2019) 3840 x 1644 pixels</p> <p>OnePlus 8 Pro (2020) 3168 x 1440 pixels</p> 	<p>Exponential growth of the number of games available on the app stores: 677,000 on Google Play and 903,489 on the App Store.</p> <p><i>Pokémon Go</i> Brings location-based games to a worldwide audience. Rich, beautifully designed narrative games flourish as a genre on the App Store such as <i>The Room</i>, <i>The Walking Dead</i>, <i>Old Man's Journey</i> and <i>Sky: Children of the Light</i>.</p> <p>And exceptional games, dealing with more serious issues such as <i>This War of Mine</i> (surviving in wartime), <i>Papers Please</i> and <i>Bury Me My Love</i> (life of immigrants) and <i>Shadow of Naught</i> (Suicide) show that mobile games have evolved to become a mature medium and artform.</p> 

THE IMPACT OF 5G ON THE MOBILE GAMES INDUSTRY - THE FUTURE

Many game developers we spoke with look at 5G as a foundational technology, making a lot of innovations possible in the future. This means we are not only looking at the faster connections and less latency that 5G brings, but also at new delivery platforms, new business models, new types of games, new gameplay, new devices, new innovations in eSports, new services for developers and players and possibly cross-media collaborations between television, cinema and the games industry, which are not possible with the current network speeds and devices.



CLOUD GAMING

Spotify and Netflix have disrupted the music industry and home video business fundamentally. Consumers are buying into the 'all you can eat' subscription proposition massively. A similar service for videogames seems like a logical step.

However, the details on revenue shares for developers are still very vague. Musicians or right holders of music receive between US\$ 0.003 and US\$ 0.005 per stream from Spotify⁷ and other music subscription services. In Netflix's case, there is no publicly available information, but it is almost certain that they operate as a film or TV distributor and pay a fixed price for the right to stream the film or TV episode, exclusively or non-exclusively worldwide, or only for certain territories. Big studio titles with a famous cast charge more than smaller independent movies. Smaller movies are mostly bought as bundles or complete catalogues from distributors.

In addition to acquiring the rights from third parties, Netflix is also producing their own movies and series. In 2019 they spent US\$ 9.8 Billion on production.

Will Cloud Gaming disrupt the games industry as profoundly as Spotify has disrupted the music industry and Netflix the home video business and now the TV industry?

⁷ <https://www.digitalmusicnews.com/2020/08/17/how-much-does-spotify-pay-per-stream-latest/>

A profound disruption in the mobile games industry happened when the Mobile Network Operators (MNOs) lost their monopoly in the delivery of games. In an interesting article in Pocket Gamer about the early days of Mobile Gaming, Chris Wright says: “On January 9th (2007), the touchscreen iPhone was announced, launching five months later in the US to mass consumer hysteria. There was no denying it was a lovely piece of technology and it isn’t even a bad phone, but what was truly innovative for the mobile games industry came with the launch of the App Store in July 2008. Suddenly, here was a platform that enabled consumers to buy games as easily as they had bought MP3s via iTunes. It also enabled developers to sell their games directly to consumers without having to deal with publishers and operators.”⁸

One month later, in August 2008 the Android Market launched, which later became Google Play.

COULD CLOUD GAMING EMPOWERED BY 5G BE THE NEXT DISRUPTION?

The advocates of Cloud Gaming promise a future whereby a consumer can pick a game from a large catalogue and play it on any device, without having to download the game.

Cloud Gaming is only possible in an environment with a reliable internet connection between the player’s device and the cloud. All rendering and game logic are processed in the cloud on remote CPUs/GPUs and streamed to the player. The player sends his commands back to the cloud using the device of her or his choice. This could be an Android phone or an entry-level laptop.

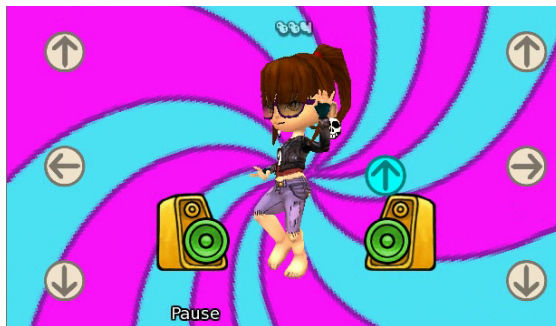
In reality today, these services can only work in a limited number of big cities with fast internet connections, located close to the cloud servers. But in the future, faster and more stable connections will make it possible in much more areas.

With 5G consumers can download or stream AAA mobile games to their mobile devices, faster and independent of any platform, directly from a Cloud Gaming service or directly from publishers. For developers, this creates new opportunities, especially in China, where the Android market is very fragmented.

Cotton, the Award Winning Chinese indie developer says:

“In the future, you may not need to download a game from a platform. Just open this window and play any game. I think it’ll be more convenient for me. I won’t be worrying about how to deploy the game. I’ll simply build the game, give it to some Cloud Gaming service, who will help us do the rest. It’ll be a good change for us.

These Cloud Gaming platforms can help us focus on developing good games and spare us the concerns about how to sell the games.”



Pictured above are images from Digital Legend’s *Dance Fabulous*, for the launch of nGage.

⁸ <https://www.pocketgamer.biz/feature/10723/a-brief-history-of-mobile-games-20078-thank-god-for-steve-jobs/>



A stable and robust Cloud Gaming service, with a large catalogue and better revenue sharing propositions, may bring a lot of good to the industry and may make a lot of innovations possible, only imaginable today. While we don't think Cloud Gaming will replace the sale of stand-alone games entirely, it will have an impact on the industry.

These games will have the advantage of streaming instead of downloading offered by 5G.

POSITIVE EFFECTS OF CLOUD GAMING ON THE INDUSTRY AND ADVANTAGES FOR PLAYERS

- Cloud Gaming can make gaming accessible to people who stopped gaming because of the costs: gaming becomes cheaper: no need to buy new consoles.
- Cloud Gaming can offer players more ways to engage with games. While playing, they can view and learn from other players, produce in-game content, share virtual items, etc.
- Cloud Gaming can offer multiplayer possibilities or collaborative options for games that are not designed as multiplayer games.
- Cloud Gaming can offer non-gaming entertainment as well, such as listening to music together, watching a video together, working from home (WFH) and screen sharing for teams. These services are actually already offered by Cloud Gaming service PARSEC⁹.

POTENTIAL ADVANTAGES OF CLOUD GAMING FOR DEVELOPERS

- Build once and deploy on many platforms, without additional coding, which saves costs and resources.
- Opportunities for new types of gameplay such as user generated levels, characters, items, events, etc.
- Opportunities for more interaction with players (live-ops), using video streaming, in-game 'live' tutorials, cheats, rewards, etc.
- Opportunities for collaborative development with other studios or brands.
- Opportunities for powerful analytics services, using AI in the cloud.
- Additional development services, such as screensharing for teams, WFH, productivity tools, etc.

⁹ <https://parsecgaming.com/>

CLOUD GAMING TECHNOLOGY ALSO MAKES THESE ALTERNATIVE CASES POSSIBLE.

- The large game developers and publishers could launch their own cloud service and offer their Game as a Service (GaaS) to their players directly, organize their own tournaments and offer some or all of the innovative services mentioned above.
- Players could rent their own cloud service and share their games, play together, buy together or create gaming experiences together.
- New start-ups could emerge, offering cheaper and more attractive alternatives to subscriptions, such as pay per play, micro transactions for extra features in a game, free low-end devices in exchange for long-term commitments (operators), etc.

IN CONCLUSION, 5G WILL EMPOWER CLOUD GAMING AS AN ALTERNATIVE TO THE ANDROID AND IOS STORES WHO ARE DOMINATING MOBILE GAMES DISTRIBUTION TODAY

- With 5G the current Cloud Gaming platforms will be able to host any game, including big AAA games, and offer stable high-speed streaming and responsiveness on mobile devices.
- 5G networks will offer Cloud Gaming platforms the possibility to offer additional services to players, such as chat, matchmaking, streaming, viewing, WFH, screensharing and more.
- 5G networks capabilities will enable Cloud Gaming platforms to offer advanced gaming services such as AR, VR and Mixed Reality (MR).



Pictured above is a screenshot from Call of Duty: Mobile, created by Activision and TiMi Studios.

MOBILE MULTIPLAYER, CONTENT-RICH GAMES

The importance of reliable, low latency networks is the highest with AAA mobile multiplayer games such as *Dragon Raja*, made by Archosaur, and *Call of Duty: Mobile*, created by Activision and TiMi Studios.

We interviewed the company behind *Call of Duty: Mobile*, the winners of multiple awards, including *Excellence in Game Play* and *Best Technical Achievement* at the 16th IMGA in 2020.

And Ray (tech lead) and Benywu (lead designer) at TiMi Studios, the makers of Call of Duty: Mobile say:

Ray: “An improvement in the network will provide a huge opportunity; it’s going to bring about an essential leap for multiplayer games. We’ll be able to try developing more content styles for an even wider mobile gaming audience, such as real-time tactics experiences.”

Benywu: “With current network capabilities, every time a global game releases a major new update, it has to work hard to make downloading and installing easier. Mobile games with the pursuit for AAA quality have a lot of high quality assets and effects. I think with 5G, these games will be viewed like a mini app. Players will be able to download or update the game easily wherever they want.”

Today, AAA mobile multiplayer games are extremely popular in China, Southeast Asia and they reach growing audiences in Japan, Korea and in the West. *Call of Duty: Mobile* is a good example of a title, which is enjoying worldwide success and has successfully attracted professional players for their mobile eSports events.

IN CONCLUSION, 5G WILL BRING A LOT OF IMPROVEMENTS TO THE MOBILE MULTIPLAYER ARENA

- 5G will multiply a new genre of mobile multiplayer games as ‘hangout places’, where playing, viewing, commenting, chatting, learning, trading, challenging, matchmaking and collaborating are made possible.
- 5G networks and more powerful 5G-enabled phones will have lower latency and will make new genres of mobile multiplayer games possible, such as FPS.
- 5G-enabled handsets with more powerful processors will bring the high-resolution graphics, the animations and the advanced visual effects which are today only possible on PC’s and consoles to mobile.
- The file size of AAA titles, such as *Dragon Raja*, *Call of Duty: Mobile* and the file size of their major updates require long and sometimes inconvenient download processes. Faster networks and better devices will speed up that process significantly and allow the developers to continuously improve the game, without risking losing players.



Pictured above is a promotional image from *Catalyst Black*.



MOBILE ESPORTS

eSports is sometimes seen as a business which is trying to duplicate the commercial success of professional sports. The professional sports business is huge; if we add up all major soccer (football) leagues in the world, they generated approximately US\$ 35.6 Billion¹⁰ in 2019. Today the eSports revenues have passed the US\$ 1 Billion benchmark in 2019, but grows much more rapidly, both in terms of revenue, audience (454 Million viewers up 15%) and price pools (US\$ 173 Million¹¹, up 14%). The largest price pool for eSports is for **Dota 2**: US\$ 34,330,068. 45% of that pool goes to the winning team, being US\$ 15,620,181¹². The richest individual player in 2019 was the Danish **Dota 2** player Johan Sundstein (N0tail) who made almost US\$ 7 Million in 2019. But Swiss tennis player Roger Federer and Portuguese football player Cristiano Ronaldo both made more than US\$ 100 Million in 2019.

There is still a long way ahead for eSports, but most analysts agree on a rosy outlook: audiences are growing, which boosts the price for licensing, media rights sales, advertising and sponsorship. Moreover, the videogames industry has a lot of insights in different monetization options, such as crowdfunding – **Dota 2's** prize pool is largely funded by fans and players – in-app purchases, battle passes and digital and physical merchandising.

eSports in North America and Europe are very different from the eSports markets in Asia Pacific, where mobile eSports is booming.

Kristian Segerstrale, CEO of SuperEvilMegaCorp, the makers of the first, large mobile eSports game, **Vainglory** says: "In our journey with **Vainglory**, we had a 60 frames per second, hundreds of actors, real-time multiplayer game, showcased on mobile in 2014, when the vast majority of the world was playing either **Candy Crush Saga** or **Clash of Clans**.

And what was interesting about that: it was way ahead of its time in terms of player culture. Back then, we simply didn't expect that mobile would be a medium that you would use for real time multiplayer gaming. Most people would look at it and go: 'Wait, why would I play that kind of game on mobile? Why wouldn't I play it on PC?' Especially in the West, where PC is such a large platform.

But in Southeast Asia and China people just adapted and that very rapidly grew into the larger category of gaming. Now, fast forward a few years, if you look at Twitch or YouTube, the largest channels and the largest player basis for multiplayer games actually are now on mobile. Whether you look at **Free Fire** or other games like that, you see these very large real time multiplayer gaming places on mobile. We are witnessing an explosion in mobile multiplayer gaming and mobile multiplayer as a hangout for kids, be that **Road Blocks**, **Fortnite** or **Free Fire**. And 5G is going to be a very large multiplier on that."

¹⁰ https://en.wikipedia.org/wiki/List_of_professional_sports_leagues_by_revenue

¹¹ <https://www.greenmangaming.com/fr/the-money-game/>

¹² https://liquipedia.net/dota2/The_International/2019#Prize_Pool

Although mobile eSports is a small portion of the total eSports arena today, in terms of revenue, number of tournaments and prize pools, it is the fastest growing segment, especially in China and Southeast Asia.

At the 2019 SEA Games, a leading eSports event in Southeast Asia, six eSports games were official medal events with two of the featured games being mobile: **Arena of Valor** and **Mobile Legends: Bang Bang**.

Call of Duty: Mobile launched in 2019 and started its first Global Mobile eSports Tournament in April 2020. Today, the prize pool for Stage 4 amounts to US\$ 1 Million.

Two much anticipated upcoming titles in 2020 are **League of Legends: Wild Rift** by Riot Games and **Catalyst Black** by SuperEvilMegaCorp.

The current strength of Mobile eSports vs traditional eSports on PC, Console and LAN, is that there is a very strong social element in the games. As Kristian Segerstrale states above, mobile multiplayer games are becoming hangout spaces for players, where people chat, connect with friends, search for tournaments, watch tournaments, participate in amateur tournaments, follow streamers, follow players, learn more about the game and much more. This especially relevant for mobile eSports; mobile players have a longer history in social gaming than players on other platforms.

Today, mobile eSports games have a relatively large female audience, especially Arena of Valor (60% female players in China), whereas the professional eSports in the West have a very low representation of women, probably lower than 5%¹³. This means that Mobile eSports will have a much larger audience as the tournaments and number of games grow.

The success of Mobile eSports in China and Southeast Asia is largely due to the fact that most players play on mobile; PC is a much smaller platform. It is not unlikely that the West and other regions will follow the trends in Asian Mobile eSports.

IN CONCLUSION, WE EXPECT THE FOLLOWING INNOVATIONS AND IMPROVEMENTS IN MOBILE ESPORTS AS 5G ROLLS OUT

- 5G will bring improvements in mobile eSports games in terms of graphics, animations and visual effects, as we saw above in the multiplayer section.
- 5G will offer less latency, which will make mobile eSports games more competitive and could open the door to new genres, such as FPS.
- With the 5G roll out, Mobile eSports will not only grow in mature markets, but will grow super fast in Mobile First countries such as the Middle East, Africa and South America, leaving eSports on PC behind.
- 5G offers better connections, which facilitates the introduction of innovative services for players, viewers, streamers and other parties involved in Mobile eSports. These services can be offered in real time, during tournaments.



¹³ <http://www.womeningames.org/women-in-esports/>

VR, AR AND MR

IDC estimates a five-year compound annual growth rate (CAGR) in AR/VR spending of 76.9% worldwide in 2019–2024 to reach US\$ 136.9 Billion by 2024.

Commercial use cases will account for nearly half of all AR/VR spending in 2020, led by training for virtual reality (\$1.3 Billion) and industrial maintenance for augmented reality (US\$ 375.7 Million). The AR/VR use cases forecast to see the fastest spending growth in 2019–2024 are lab and field (post-secondary, 133.9% CAGR), lab and field (K-12, 127.0% CAGR), and public infrastructure maintenance (111.4% CAGR). On the consumer side, spending will be led by two large use cases: VR games (US\$ 3.0 Billion) and VR feature viewing (US\$ 1.2 Billion¹⁴).

With these impressive growth estimates, we can expect the overall addressable market for mobile VR and AR games to expand in the future. With a larger addressable market, we will see bigger independent publisher (IP) and AAA games come to the mobile platform.

Mobile games serial entrepreneur Tommy Palm is the co-founder of Resolution Games, based in Stockholm, Sweden. Resolution Games is an Award Winning and successful company specializing in VR, AR and Mixed Reality (MR) games. The company is making games for all mobile VR platforms, including the Oculus Quest and recently launched *Glimt: The Vanishing at the Grand Starlight Hotel* on the Magic Leap 1, the first mixed reality device. Their game *Acron: Attack of the Squirrels!* is a VR game which must be played with at least two other people who join the game on mobile devices. The game won **Best VR Game** and the game *Angry Birds AR: Isle of Pigs* which they made with Rovio won **Best AR Game** at the 16th IMGA in 2020.

Tommy Palm: “You have these people playing our game *Acron: Attack of the Squirrels!* together and you need reliable internet. Obviously, you don’t have the chance of using a cable. [...]. Wi-Fi is notoriously bad for very crowded places and here is one area where 5G really can make a difference. It’s designed with that specifically in mind that you have a situation where Internet can’t fail. If you’re doing a big eSports competition and it’s the finale, people have been training for a year. Live Event, people in the audience, and Internet just can’t fail. Like that’s number one priority, because you spent a lot of money building up to this. It’s really like playing a soccer match and all of a sudden, the goals aren’t there anymore!

I think that location-based games have an interesting connection with AR. AR and location-based games don’t have to be the same thing, but they work really well together. People’s favorite example is *Pokémon Go* of course, that is one of the games that became this global phenomenon again.”



Pictured above is a promotional image from *Dragon Raja*.

¹⁴ <https://www.idc.com/getdoc.jsp?containerId=prEUR146720420#:~:text=But%20the%20long%2Dterm%20outlook%20remains%20strongly%20positive%20%E2%80%94%20IDC%20estimates,reach%20%24136.9%20billion%20by%202024.&text=Europe%20accounts%20for%20roughly%2015,be%20%241.6%20billion%20in%202020>



Pokémon Go developer, Niantic Labs, announced on September 1, 2020 a bold initiative called the Niantic Real World Platform, a 'Planet-Scale AR Alliance' between Niantic and mobile network operators Deutsche Telekom, EE, Globe Telecom, Orange, SK Telecom, SoftBank Corp., TELUS and Verizon.

Niantic Labs' VP of Growth Omar Tellez tells in a blog post: "The ongoing rollout of ultra fast 5G networks and compatible devices in the coming year presents a number of exciting opportunities for us on that front. We're confident that 5G networks can accelerate our vision of bridging the physical and digital worlds with advanced AR functionality such as real-time synchronous multiplayer AR experiences in a shared environment, persistence, and visual occlusion through contextual computer vision. These advanced features, which are part of our Niantic Real World Platform, will take full advantage of 5G's ultra-low latency (i.e.: 1 millisecond in 5G vs. 50 milliseconds in 4G¹⁵), and increased throughput (i.e.: up to 50 Gigabits/sec in 5G vs. 20 Megabits/sec average in 4G¹⁵) to provide seamless experiences for our users."¹⁵

Tommy Palm: "AR is something that is now typically run on your phone locally, but if you had a powerful internet connection, you could stream your camera content and get help from the cloud in order to create fantastic things where you see other people playing in the streets and their virtual experiences, too. And that creates a very, very good setup for multiplayer and fantastic illusions, where you can see something together as a community, which you can't do today."

IN CONCLUSION, WE EXPECT THAT 5G WILL HAVE A POSITIVE IMPACT ON THE GROWTH OF MOBILE AR AND VR GAMES AS FOLLOWS

- 5G will boost the capabilities of the wireless VR headsets to download high quality graphics and visual effects faster, which will result in a much smoother experience.
- 5G will allow more realistic 3D experiences in AR and MR; for instance, real-time rendering in the cloud of 'skins' on buildings, people and moving objects.
- In general, 5G will make VR games more immersive and will enhance the artistic possibilities; for instance, as Tommy Palm stated, simulating a walk in the forest, or better representing human beings.
- More stable connections will allow better multiplayer games in VR and AR.
- Industry initiatives such as Niantic's Real World Platform, based on 5G, will boost location-based gaming in combination with AR, using the capacities of real time rendering that 5G can bring.

¹⁵ <https://nianticlabs.com/en/blog/5g/>

THE FUTURE OF STORYTELLING, PERVASIVE GAMING AND AI IN GAMES

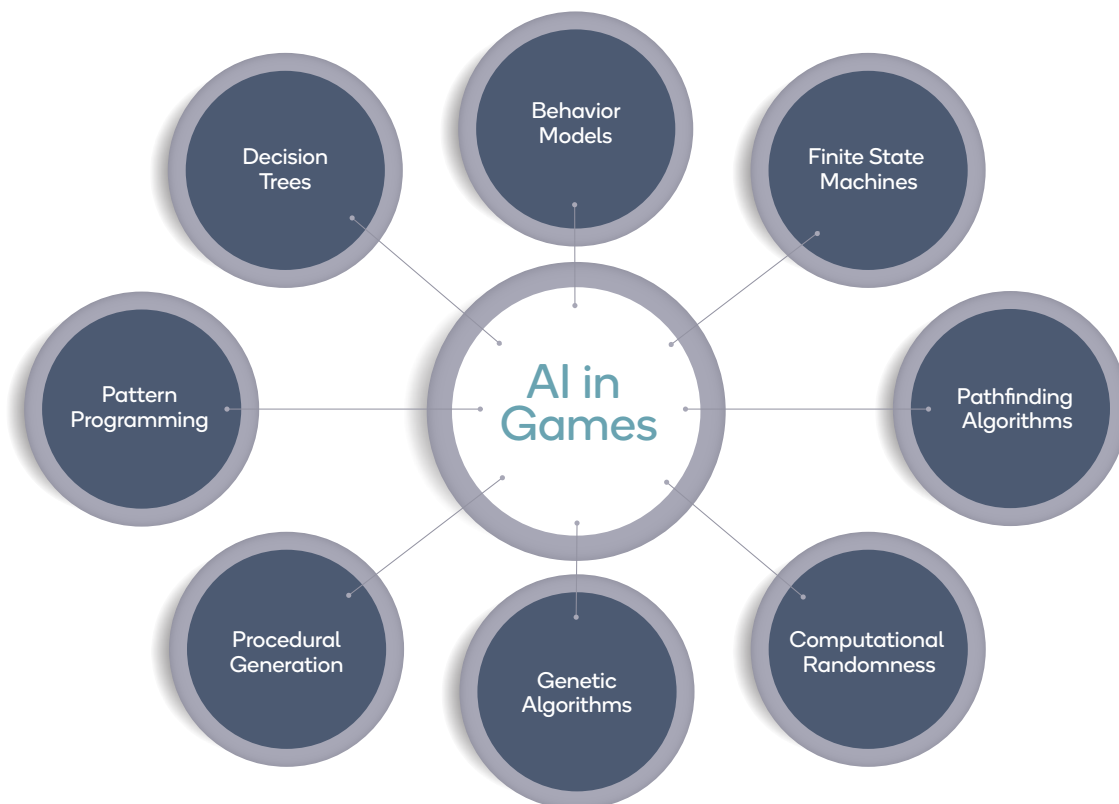
The television, cinema and videogames industries have often predicted the emergence of a new type of genre where all three of these mediums are merged in an interactive manner. They called it multimedia in the last century, then transmedia storytelling and convergence in the beginning of this century, and now cross-media.

However, the predictions of these independently published properties finding their way too many different screens at the same time never happened because the TV industry, the movie industry and the videogames industry are just very different. However, new technology and new business models could add new dimensions to existing traditional media.

According to actor Joseph Gordon-Levitt, it's going to be video games – not feature films – that will push storytelling forward in new and exciting ways. Appearing on a recent episode of *Hot Ones*¹⁶, Gordon-Levitt said he sees more room for growth in storytelling in video games than film.

The Walking Dead, winner of the **Grand Prix** of the 9th IMGA in 2013, *The Room*, *Framed* and *Forgotton Anne*, the winner in the category **Excellence in Storytelling** at the 16th IMGA, showcase the growing quality of storytelling in mobile games.

5G will bring the old dream of convergence and a new genre of interactive TV, cinema and storytelling in games a step further. We can expect a new kind of series, whereby players or viewers can create their own episodes and share them, or even sell them online. With powerful 5G connections we will be able to watch, create, alter, receive and share episodes on mobile devices.



¹⁶ <https://www.youtube.com/watch?v=HDduzlB8HjU&feature=youtu.be>

As we stated earlier, 5G can be seen as a foundational technology, bringing a lot of new use cases to the mobile games industry. We looked at some of them above, but there could be a lot more that are less visible at this point in time.

There has been a lot of development in Artificial Intelligence and Deep Learning and 5G could bring very powerful tools to game makers with 'artificial intelligence in the cloud', AI combined with cloud computing.

Developers see a lot of use cases for these advanced versions of AI in the cloud.

Cotton, the Award Winning Chinese indie developer says: "Normally in an RPG, the words, the sentences (of the characters) need to be written in advance. But with the help of AI, what the NPC says will be infinite. I'm always so annoyed by our traditional way of making NPC contents. But if I use high-tech, I can put more and more NPC contents into our game.

And (the AI-generated contents can be so good that) the players won't be able to tell if a certain character is an NPC or a player. Because these AI NPCs can talk really, really well."

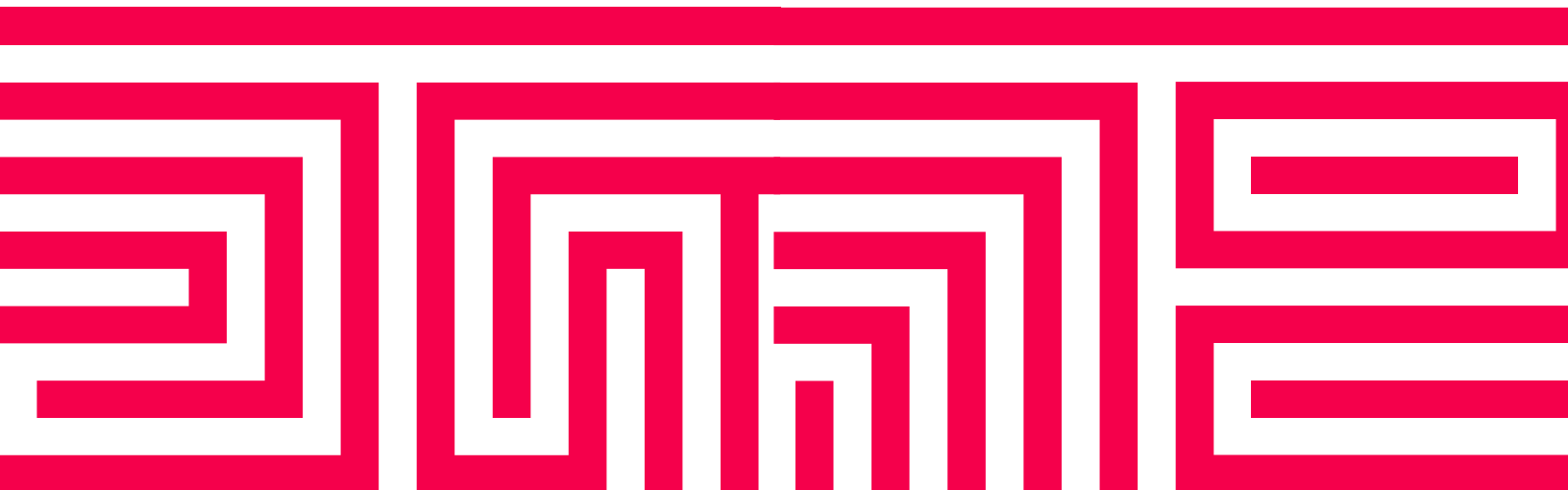
AI is also used in learning more from players and what they enjoy and what makes them stop playing. More powerful AI will help game makers adapt their games faster and better or maybe even personalize the gaming experience more.

Paul Gadi, a serial entrepreneur in mobile games and founder of Blockchain enabler Outplay Games says: "So the Internet of Things. Right? Like these devices are able to connect. A lot of things you can do there. I think we got glimpses of it already with **Pokémon Go**, a device is connected and tracks where you are. So, what if it's not just your phone, but your watch or select something else like your car, your clothes and you can make a bigger data layer on top of the game.

It's not just phones, but you can create an entire city using the sensors like an Internet of Things. So there's probably going to be some gameplay. You can build on top of that.

Like a more virtual city. Imagine that these devices are enabled to transact with each other. These sensors become agents themselves. So maybe you can create some ecosystems around that. So it's still very SciFi, but yeah, Bitcoin came out of nowhere. Right? Maybe there's something new that's going to appear with all of this technology."

What Paul describes here is an advanced version of Pervasive Gaming, or Big Games, experiments that took place in the beginning of this century. But in the future, with more 5G-connected devices, gaming would not necessarily be limited to a phone but could extend to any connected 'thing'.



Created in 2004, the IMGA is the longest standing mobile games award program. With its long history and unique judging process, it has discovered some of the world's most popular titles in their early days, such as **Angry Birds**, **Candy Crush Saga**, **Monument Valley** and **Pokémon Go**. It is the only competition that unites the industry by celebrating excellence and innovation in games. In 2016 the IMGA launched local competitions in China and the Middle East and North Africa region, along with an international competition. The 16th IMGA is sponsored by MyGamez, Supercell, The City of Helsinki, Qualcomm Technologies and Resolution Games.

Qualcomm is the world's leading wireless technology innovator and the driving force behind the development, launch, and expansion of 5G. When we connected the phone to the internet, the mobile revolution was born. Today, our foundational technologies enable the mobile ecosystem and are found in every 3G, 4G and 5G smartphone. We bring the benefits of mobile to new industries, including automotive, the internet of things, and computing, and are leading the way to a world where everything and everyone can communicate and interact seamlessly.

Qualcomm Incorporated includes our licensing business, QTL, and the vast majority of our patent portfolio. Qualcomm Technologies, Inc., a subsidiary of Qualcomm Incorporated, operates, along with its subsidiaries, substantially all of our engineering, research and development functions, and substantially all of our products and services businesses, including our QCT semiconductor business.