

HOW 5G WILL TRANSFORM THE BUSINESS OF MEDIA & ENTERTAINMENT

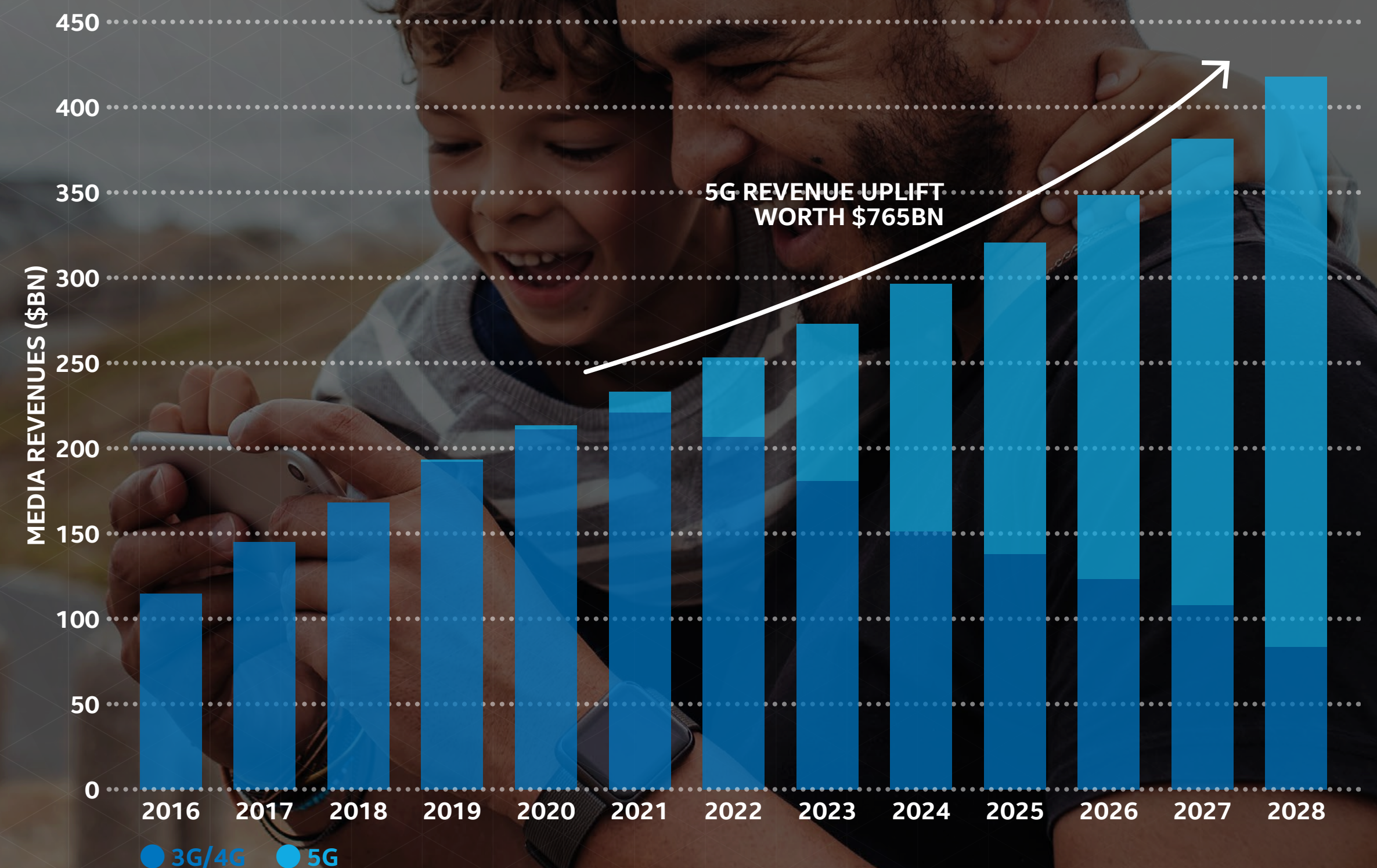
OCTOBER 2018

SUMMARY

The global media industry stands to gain \$765bn in cumulative revenues from new services and applications enabled by 5G (\$260bn in the US and \$167bn in China). Thanks to the new network capabilities brought by 5G, annual mobile media revenues will double in the next 10 years to \$420bn in 2028 (\$124bn in the US). The transformative impact of 5G will go well beyond just enhanced mobile media. It will disrupt the industry on many levels, with new business models and new immersive interactive experiences to capitalize on. Video, gaming, music, advertising, AR, and VR will all see fundamental changes due to 5G, bringing content and audiences closer. Ultimately, we expect 5G to help bring a new, tactile dimension to entertainment.

This study was conducted by Ovum, leveraging in-depth media markets expertise from a large team of analysts and industry contacts in media and telecoms. The forecast followed a rigorous methodology process whereby each 5G use case was put against its own media market context such as market dynamics and business models, and was tested on consumers via a survey. The revenue projections and resulting analysis focus solely on consumer services, although there is also a strong opportunity for 5G in media for enterprises.

FIGURE 1: TOTAL GLOBAL MEDIA REVENUES DELIVERED OVER WIRELESS NETWORKS, 3G/4G VS 5G, 2016–2028 (\$BN)



SOURCE: OVUM

Key findings

- **5G will transform media business models.** Thanks to the new network capabilities brought by 5G, annual mobile media revenues will double in the next 10 years to \$420bn in 2028 (\$124bn in the US). Media companies that are first to embrace those new business models will be winners.
- **5G will enable new ways to interact with media.** 5G will unlock augmented and virtual reality applications that will create more than \$140bn in cumulative revenues between 2021 and 2028 (\$32bn in the US), enabling a whole new channel to reach consumers. Augmented reality will create a new way for people to connect with media through virtual items, virtual characters, and augmented contextual information. The creation of volumetric 3D content and an ecosystem to manage that type of content will be important to fully realize this market potential.
- **5G will supercharge the digital advertising market.** Mobile display advertising will present a significant revenue opportunity, with an expected market of \$178bn worldwide by 2028 (\$66.6bn in the US). 5G will have a fundamental role in transitioning traditional display advertising toward social and media immersive experiences. Scale, delivery, and measurements are key challenges for mobile ad campaigns today, which 5G will help overcome.
- **5G will triple mobile media revenues in China to \$100bn.** Chinese national mobile operators and media companies will see many benefits from aggressive 5G network rollouts. China will be the largest market in the world for VR and AR by 2028 with over \$15bn in direct revenues.
- **5G will be a major competitive asset for network providers in media, B2B and B2C.** Video will see substantial market transformation from 5G – mobile video revenues over 5G will grow with a CAGR of 85% between 2021 to 2028. 5G will bring economies of scale to network providers' TV offerings with a much wider footprint, competing against IPTV, cable, and satellite. On the B2B front, 5G will help operators capitalize on mobile media growth by selling 5G network capabilities to OTT video service providers.
- **Longer term, 5G will bring new senses to media: touch and feel.** Highly responsive haptic suits merged with advanced VR capabilities, such as Ready Player One, will unleash a new sensation dimension to media consumption. This type of new VR experience will emerge in 2025 and will generate over \$5bn annually by 2028 (\$1.5bn in the US). Now is the time to bet on the right technology that will enable this, including 5G.
- **Gaming will be at the forefront of 5G-led innovation.** AR games will make up more than 90% of 5G AR revenues by 2028 (\$35.7bn globally). Fast responsiveness and high-resolution, real-time streaming will also help unlock mobile cloud, gaming. Overall 5G mobile games revenues, including AR and cloud gaming, will exceed \$100bn annually in 2028 (\$20bn in the US).

THE REVENUE OPPORTUNITY

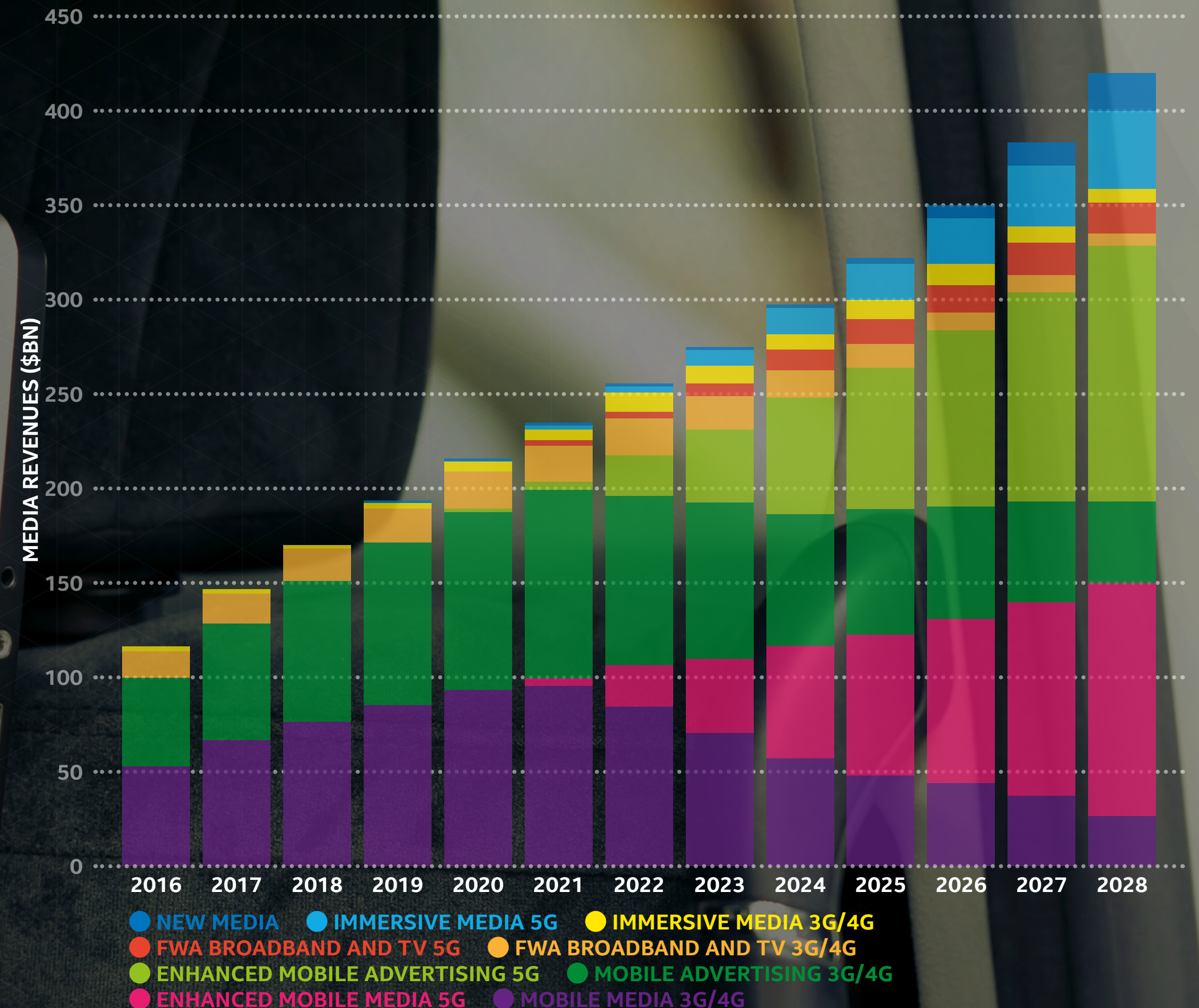
5G will bring tremendous growth to the media and entertainment industry in the coming years. 5G will grow the global mobile media market from \$170bn in 2018 to \$420bn in 2028 (\$124bn in the US), a CAGR of 9.8% over 10 years. 5G revenues will overtake 3G/4G revenues by 2025 globally (2023 in the US) and total net new revenues coming from 5G will account for \$200bn in 2028 (\$67bn in the US). 4G alone cannot deliver that level of transformation, and not moving to 5G fast enough may become a risk to businesses.

5G will start to realize its full transformational potential from 2022 onwards, when we will start to see a significant impact on traditional media usage, mass-scale adoption of AR and VR, and the emergence of new use cases such as 3D holographics, haptic suits, and advanced interactive entertainment. Immersive and new media applications will reach an unprecedented scale by 2028, generating in excess of \$67bn annually – this is equivalent to the value of the entire mobile media market (video, music, and games) last year.

5G media revenues can be categorized as follows:

- **Enhanced mobile media (video, music, and games):** This corresponds to the use of paid-for and bundled-in traditional media including video, music, and gaming on 5G networks.
- **Enhanced mobile advertising:** This corresponds to mobile display advertising such as videos, banners, in-game placement over 5G, and other visual advertising formats that may appear in VR and AR environments.
- **Home broadband and TV:** This corresponds to the use of 5G as the primary home internet connection bundled with a TV package. This type of connection is also referred to as fixed wireless access (FWA).
- **Immersive media (AR, VR, and cloud gaming):** This corresponds to augmented reality (AR) and virtual reality (VR) content and applications, as well as cloud gaming delivered over 5G. AR, VR, and cloud gaming are not new, but 5G offers the opportunity to unlock their use to mass-market level.
- **New media:** This corresponds to new applications that do not really exist today and that 5G will enable in the future. This includes self-driving car entertainment, 3D holographic displays, and connected haptic suits among others.

FIGURE 2: 5G IMPACT ON MEDIA REVENUES, GLOBAL, 2016–28



SOURCE: OVUM

Enhanced mobile broadband to boost media usage and revenues

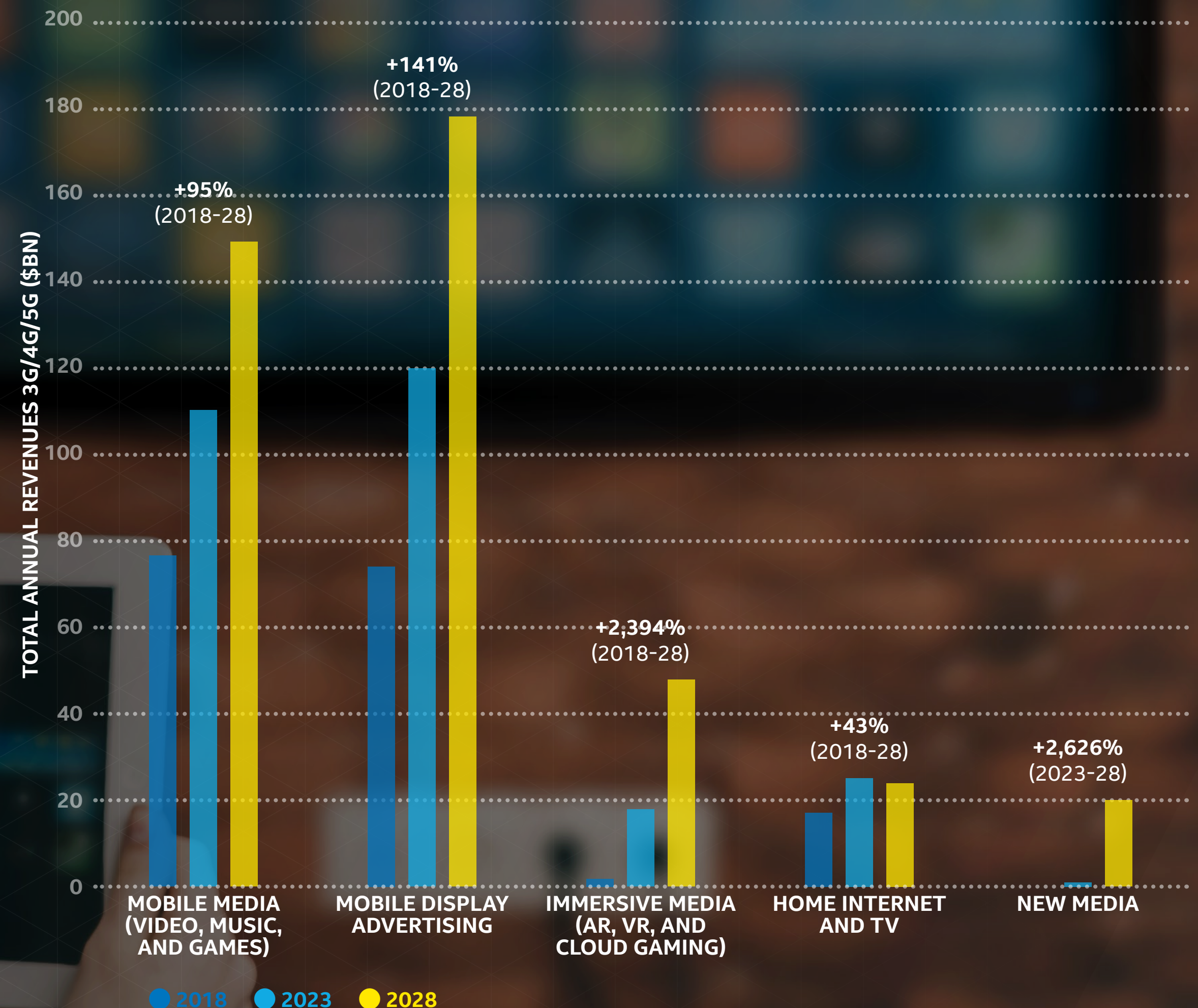
5G will drastically increase media usage. The average monthly traffic per 5G subscriber will grow from 11.7GB in 2019 to 84.4GB per month in 2028, at which point video will account for 90% of all 5G traffic. Figure 3 illustrates 5G's ability to transform this increased usage into revenues, from already large established segments such as gaming and advertising, to yet to be unlocked new ones such as AR and VR.

5G will grow the global media market over cellular networks from \$170bn in 2018 to \$420bn in 2028 (\$124bn in the US), a CAGR of 9.8% over 10 years. Consumer spend for video, music, and games on mobile will nearly double by 2028 to reach almost \$150bn globally (\$29bn in the US).

The fundamental drivers that will help realize this multi-\$100bn opportunity are:

- **Enhanced mobile broadband** will deliver a seamless, high-quality experience for media streaming services such as Spotify and Netflix. The global paid-for video, music, and games market delivered over cellular networks will almost double in the next 10 years, from \$77bn in 2018 to nearly \$150bn in 2028.
- **Lower cost per bit** will bring affordable and truly unlimited mobile data packages, better adapted to heavy media usage.
- **New business models** such as bundling and more effective advertising using real-time data analytics will spur the adoption of media services over 5G. 5G bundles will account for 27% (\$11bn) of global mobile video and music revenues in 2028.

FIGURE 3: MARKET TRANSFORMATION OPPORTUNITY BY MEDIA SEGMENT, GLOBAL, 2019–2028








SOURCE: OVUM

New media opportunities will generate \$185bn in the next 10 years

There are many new opportunities that 5G will enable in the next 10 years besides just growing usage of traditional media on mobile:

- **Advertising** will be the most impacted by 5G in terms of value; 5G will add an extra \$100bn to annual mobile display advertising revenues by 2028 (\$35bn in the US). This will correspond to a net cumulative growth of more than half a trillion dollars in the next 10 years (\$280bn in the US). The advertising market will benefit from incremental usage of services such as video, the emergence of new immersive formats enabled by 5G, and resulting social integrations. The best way to prepare is to participate in early experimentations with 5G, not necessarily to get first-mover advantage, but rather to understand what is achievable and be ready to move in at the right moment.
- **Entertainment you can feel** offers tremendous opportunities for the media industry in the long term. Haptic suits connected to 5G will be able to deliver a new sensory dimension to media experiences. For instance, new sensations such as heat and pressure could be bundled into a weapons upgrade in an action game, or movies could be re-released with a new sensation layer, opening a new monetization cycle across old catalogs.
- **New media** experiences to be enabled by 5G such as in-car entertainment, 3D holographic displays, and live in-stadium experiences are all set to bring in a cumulative \$43bn in the next 10 years (\$23.5bn in the US). In all cases, 5G will bring fans and their idols closer, something to be considered as of great value to consumers.
- **New immersive interactive experiences** will be unlocked by 5G. AR, VR, and cloud gaming combined will grow nearly 2,400% in the next 10 years to reach yearly revenues of \$47.7bn in 2028 (\$8bn in the US). The cumulative revenue contribution from 5G over the forecast period will be \$142bn globally (\$32bn in the US). 5G will benefit from a perfect storm expected around 2023–25, when hardware and network capabilities will help realize VR experiences that are close to reality. Human-scale 210-degree horizontal field of vision, six degrees of freedom for movement, high pixel-density display/projection resolution, miniature battery size, and highly responsive interaction are some of the elements that are required to reach this inflection point.
- **Mobile edge computing will be key.** These experiences won't be achievable solely through stand-alone hardware and will require some of the computational power to be executed remotely on the network. Mobile edge computing (MEC) capabilities that 5G will feature will be key. On the content side, there will need to be an ecosystem around 3D volumetric content creation, management, and distribution, which is already emerging today (e.g., Intel Studios, Microsoft Mixed Reality Capture Studios).

TABLE 1: 5G KEY OPPORTUNITIES AND IMPACT

TRANSFORMATIONAL IMPACT		NEW BUSINESS MODELS	
	NEW ADVERTISING FORMATS AND MEASUREMENT	<ul style="list-style-type: none">• Transitioning traditional banner-based advertising to moving images, video especially.• Digital and social advertising transformation – integration and customization with immersive experiences.• Real-time dynamic measurement of ad effectiveness through eye tracking, biometrics, etc.• New ad formats in AR and VR.	
	EMPOWERED GAMING EXPERIENCES	<ul style="list-style-type: none">• 5G AR gaming will be very large (>90% of all AR revenues).• 5G-reduced lag to unlock cloud gaming on mobile.• Haptic suits and VR to transform gaming experience.	
	VIRTUAL ENVIRONMENTS AS NEW MEDIA CHANNELS	<ul style="list-style-type: none">• An entirely new way for consumers to interact with content.• Engagement levels to be much higher because of immersion.• Create a real connection between artist and fan.	
	A NEW SENSORY DIMENSION TO ENTERTAINMENT	<ul style="list-style-type: none">• Haptic suits combined with high responsiveness of 5G network will bring touch sensation over the internet.• Realistic immersion when combined with high quality VR.	
	IN-CAR ENTERTAINMENT	<ul style="list-style-type: none">• Driverless cars to bring new context in which to enjoy entertainment – set to generate an aggregate \$19.5bn in the next 10 years.• Americans spend on average 293 hours per year driving, according to the AAA Foundation for Traffic Safety.	
		<ul style="list-style-type: none">• New ways to monetize engagement and interaction brought by AR, VR, and haptics.• Less-intrusive ads mean more opportunity for ad-supported premium services (e.g., ads in Netflix).	
		<ul style="list-style-type: none">• Virtual objects to be used in games for AR and VR.• Network-dependent gaming experiences such as cloud gaming more likely to push subscription models.• Pay per sensation/feel on haptic suits.	
		<ul style="list-style-type: none">• Virtual items can be bought via in-app transactions or bundled in with digital media purchases (e.g., movie, music video).• Highly valued engagement could be priced on a per event or per minute basis for celebrities.• New advertising formats.	
		<ul style="list-style-type: none">• A new sense means an entirely new way to monetize entertainment.• Different levels or sensations could be unlocked for different price tiers.	
		<ul style="list-style-type: none">• "Car"-hold dual-play. Home entertainment subscription for the-car.• Our survey data shows that consumers are likely to pay more for in-car entertainment than for mobile entertainment.	

SOURCE: OVUM

THE IMPACT ON THE COMPETITIVE LANDSCAPE

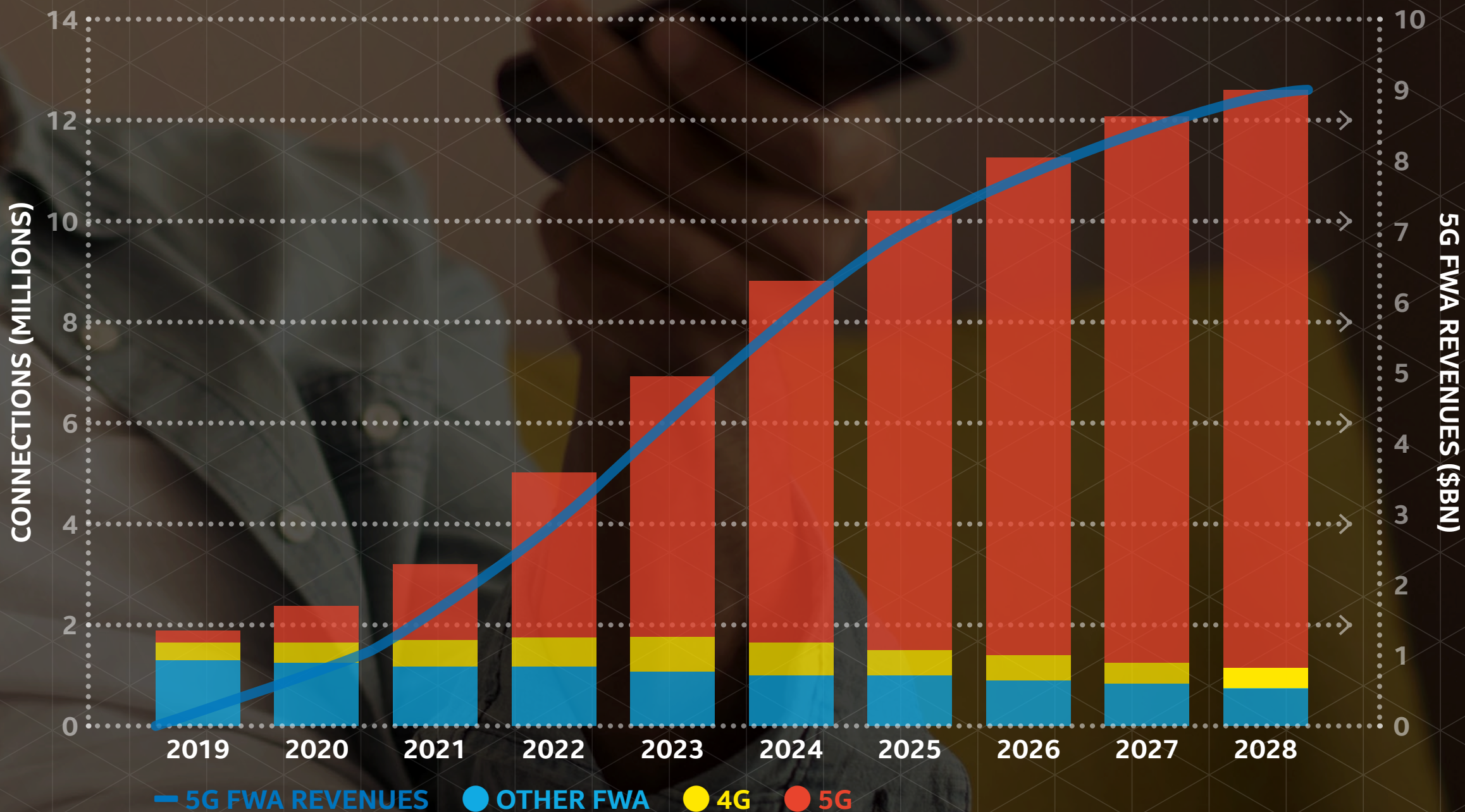
5G will enable network operators to compete better with cable and satellite operators

Over half our survey respondents (53% and 50% in the US and the UK respectively) indicated they would be interested in switching to 5G providers for their connectivity and TV services. 5G network capabilities will enable converged fixed/mobile wireless service providers to reach economies of scale and offer bundled services, of which residential connectivity and TV and video services are likely to be the first.

We anticipate significant inroads to be made into consumer spending on residential broadband and TV services by 5G network operators at the expense of fixed broadband and traditional pay-TV providers. As 5G speeds ramp up, the existing differentiation in broadband speeds enjoyed by cable and other fixed network operators over cellular will be eroded.

The US is the market where this opportunity is the strongest. Almost 9% of broadband households will use 5G as their main broadband connection by 2028, generating nearly \$9bn in revenues. This may seem small in comparison to consumer interest rates recorded in the survey, but we expect fixed broadband providers to align with 5G offerings and compete aggressively.

FIGURE 4: 5G FWA CONNECTIONS AND REVENUE PROJECTIONS, US, 2019–28



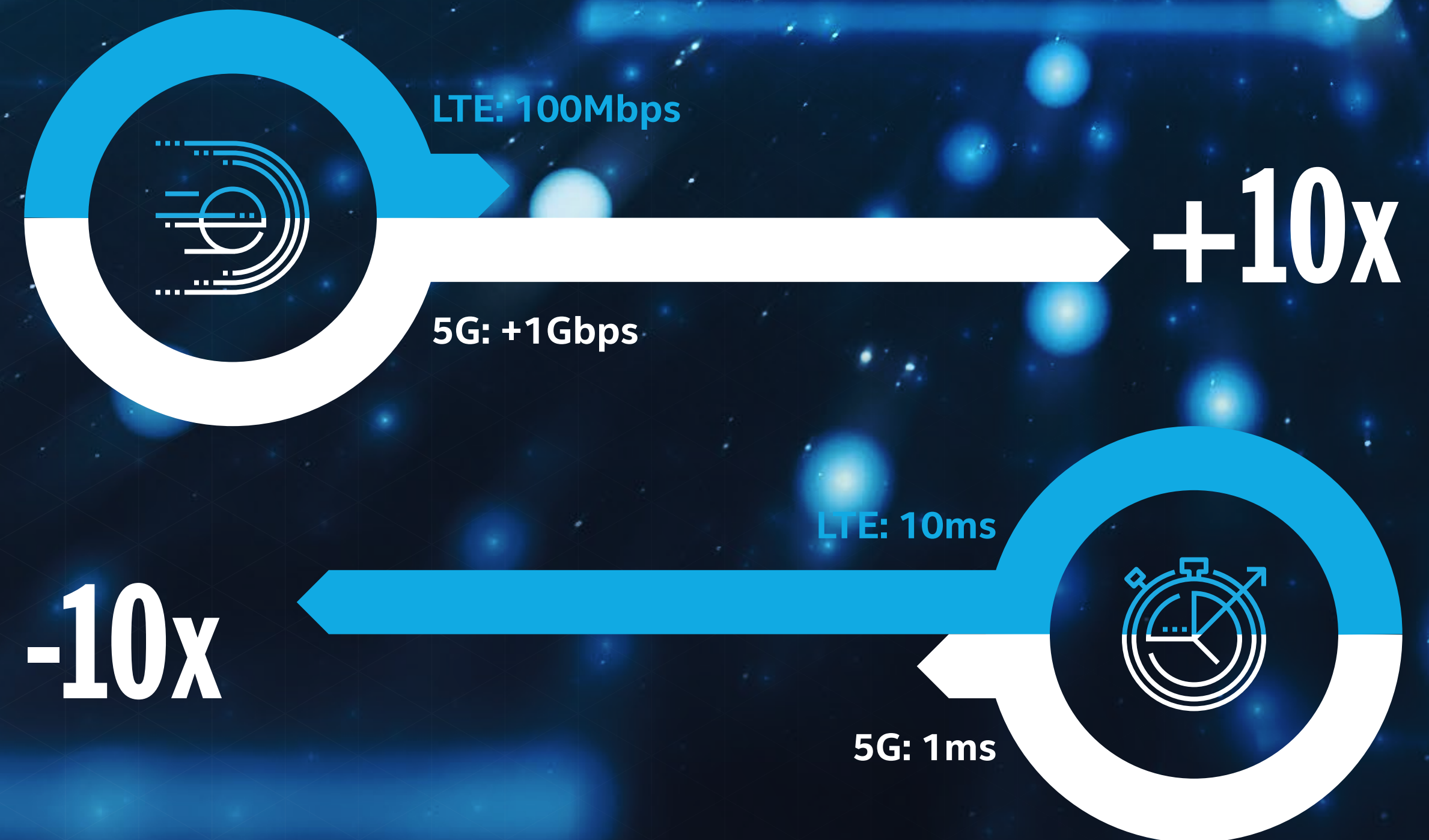
SOURCE: OVUM

THE TRANSFORMATIONAL POTENTIAL OF 5G

5G will usher in not only a new era in mobile communications performance, but new classes of consumer and business services as well. 5G is transformational when it comes to the services it will enable thanks to its networks capabilities.

When looking at new mobile networks, the most logical place to begin is with the access network. 5G will bring very distinct improvements over LTE in this area. Using advanced antenna technologies, improvements in the air interface, and access to new spectrum bands, 5G can provide speeds greater than 1Gbps, a tenfold increase over many of today's LTE networks. Latency will also significantly improve in the access network, with 5G being designed to deliver 1ms of latency.

FIGURE 5: 5G ACCESS NETWORK IMPROVEMENTS



SOURCE: OVUM

The 5G network story, however, is much more than access. 5G will bring with it major changes to other parts of the network as well. Two changes of note are mobile edge computing and network virtualization:

- **Mobile edge computing (MEC)** brings network computing capabilities closer to the network edge. MEC can help enable lower latency and better distribution of network content. Virtualization, especially the new 5G network core, will enable network slicing.
- **Network slicing** allows operators to offer different classes of services across a common infrastructure. For example, with slicing, an operator could offer one group of subscribers a service with 1Gbps guaranteed download speed and best-effort latency, while offering another group of subscribers a service with best-effort speeds above a minimum threshold of 10mbps and guaranteed sub-10ms latency. These will both be delivered on exactly the same physical network.

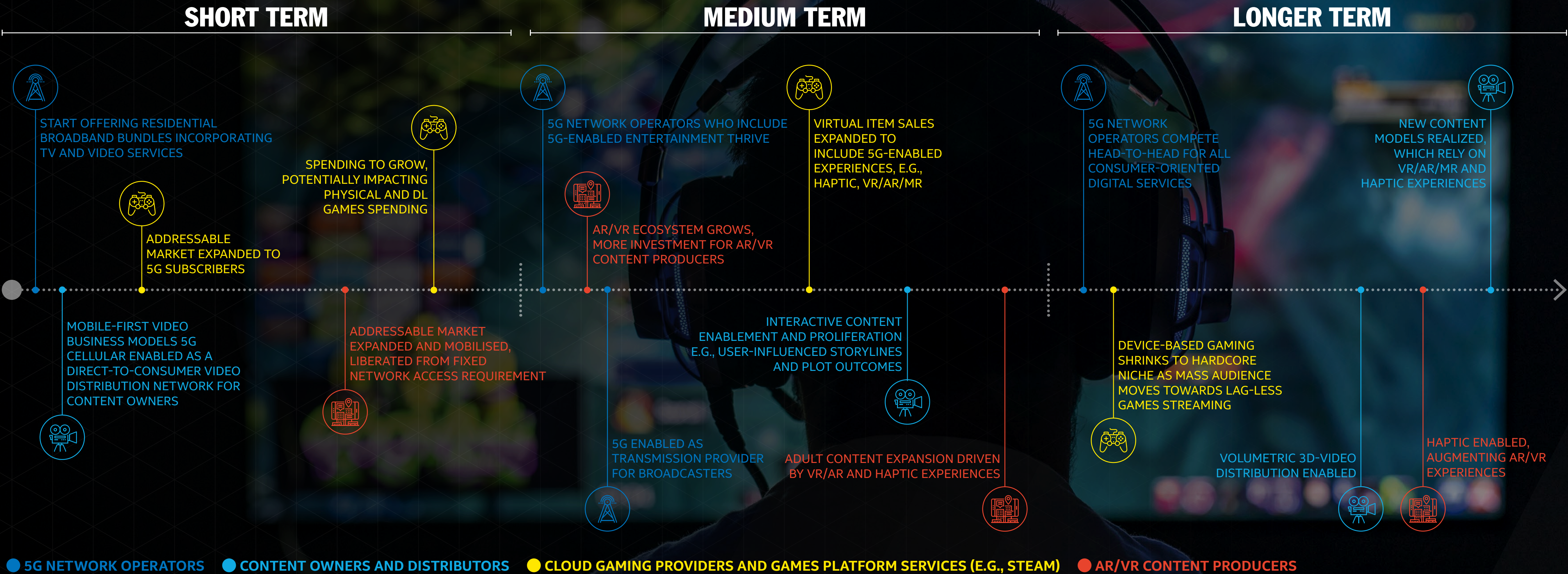


These 5G technologies will enable the creation of new services and business models:

- **Enhanced mobile media:** Mobile media consumption has been a big part of the LTE story. It will be even bigger with 5G. Thanks to capacity gains coming with 5G, mobile media consumption should increase. For mobile operators this means an ability to sell either high-data packages or even true unlimited services. Operators will further benefit as 5G lowers the cost per bit, making 1GB cost less over 5G than it does over 4G.
- **Home broadband and TV:** Higher network capacity will make it easier for mobile operators to expand into the fixed broadband market. With 100MHz of capacity, an operator can serve both the enhanced mobile and fixed broadband user from a common infrastructure. The fixed broadband market, operators are then in a better position to offer other services, such as video streaming, either alone or through partnerships.
- **Immersive media (AR, VR and cloud gaming):** Low latency will make content such as virtual and augmented reality and gaming more interactive, which in turn could create a whole new category of media. The possibility of fully interactive gaming can be made both technologically and economically affordable with 5G. The benefits of low latency and MEC are not limited to the consumer arena.
- **Localized content delivery for in-venue media:** MEC will allow for local storage of content, bringing down the cost of transporting the content and even making it easier for operators and content providers to efficiently provide targeted localized content. With MEC, new live-media experiences could be delivered in large public venues such as stadiums and concert halls.
- **New dedicated networks for high-profile media distribution:** Network slicing can allow operators to provide media companies with dedicated networks for media distribution. This will make it easier for operators to sell media companies and other content distributors a guaranteed level of performance. An operator could take a network slice and dedicate it to 4K video streaming or to the delivery of high-profile real-time events such as the Super Bowl in the US.
- **In-car entertainment:** 5G will help change the driving experience. The connected car will free up driver and passengers to consume more media while travelling. A combination of network capacity, low latency, and localized storage will improve car connectivity at high speeds, reducing network lag and stalling. It can also create new business models such as the creation of 5G hotspots, where drivers can quickly download maps or movies, or upload car diagnostics while at such places as highway rest stops or gas stations.
- **Enterprise AR and haptics:** Augmented reality can be used to share new product-design work across globally dispersed markets in real time. High-precision robotic manufacturing certainly requires low latency.

Significant competitive impacts for key 5G entertainment ecosystem players

FIGURE 6: 5G ECOSYSTEM ROADMAP

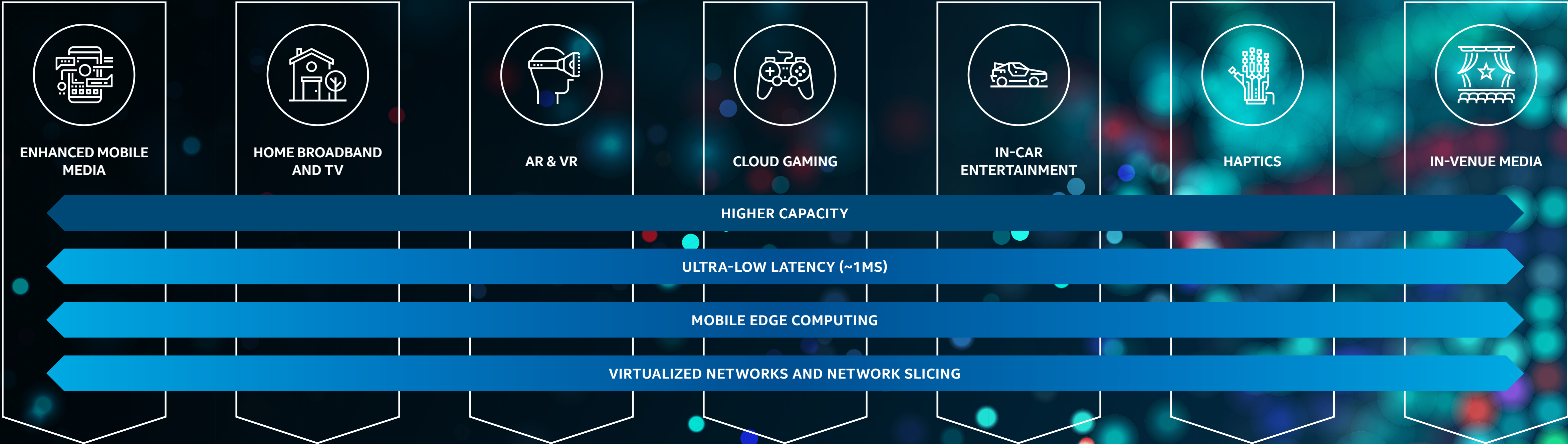


SOURCE: OVUM

5G is an end-to-end network transformation. Network changes at the access layer, along with virtualization and new architectures, can bring about new services on their own, along with creating demand for new devices, but an even greater level of changes will come when all the different 5G network elements are combined. Higher access speeds, low latency, and MEC can each enable new

services on their own, but when they are combined, new service possibilities start to multiply. Of course, these changes will take time. Not every element of 5G will be available initially, but as 5G works itself deeper into the network, newer applications and business models will be unlocked.

FIGURE 7: 5G APPLICATIONS AND SOME OF THEIR UNDERLYING TECHNOLOGIES



SOURCE: OVUM

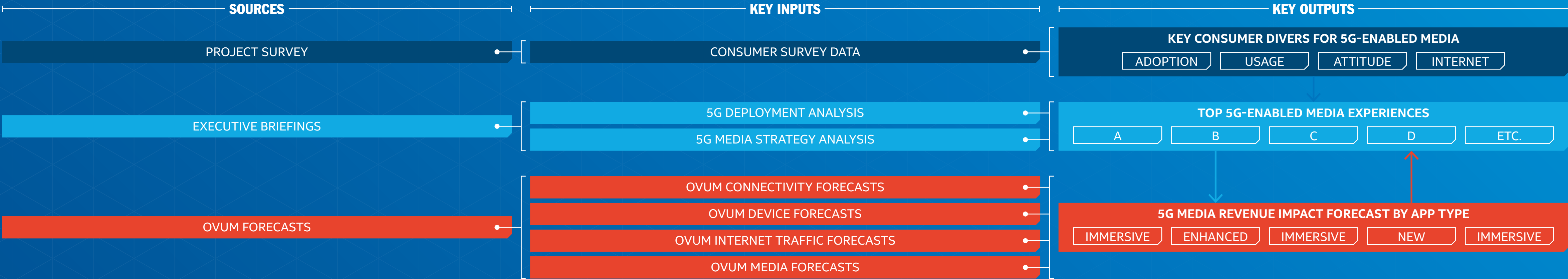
APPENDIX

Methodology

This study was conducted following a rigorous methodology process involving several sources and inputs to the forecast model, as well as a consumer survey to evaluate consumers' response to 5G use cases. Ovum extensive forecast database including 5G connections, 5G devices, media and traffic forecasts was used as key inputs. In-depth analysis on 5G network and service deployment strategies and its impact on the media industry was carried out by a team of Ovum

analysts with global expertise across the TMT value chain. Forecast assumptions were cross-validated with key members of the industry via a series of executive briefings. Throughout this process, several 5G media experiences were identified and assessed in terms of revenue opportunity and consumer interest. The latter was complemented by a consumer survey which was conducted across 4676 online respondents in the UK and the US in August 2018.

FIGURE 8: METHODOLOGY OVERVIEW



SOURCE: OVUM

• CONSUMER INSIGHTS • STRATEGY ANALYSIS • FORECAST DATA

Definitions

MOBILE MEDIA REVENUES

Total mobile media revenues are defined as consumer and advertising spend corresponding to the consumption of media content and services on all cellular networks (3G, 4G and 5G). In cases where media is bought regardless of the network on which it is delivered, a share of spend is allocated to cellular based on its contribution to total traffic. For instance, a Netflix subscription of \$10 a month with a traffic profile of 70% fixed, 20% 5G and 10% 4G would account for $30\% \times \$10 = \3 per month. The full subscription price will be accounted for in the case of cellular media bundles.

Total 5G media revenues are defined as consumer and advertising spend corresponding to the consumption of media content and services on 5G-capable devices delivered over 5G networks. In cases where media is bought regardless of the network on which it is delivered, a share of spend is allocated to 5G based on its contribution to total traffic. For instance, a Netflix subscription of \$10 a month with a traffic profile of 70% fixed, 20% 5G and 10% 4G would account for $20\% \times \$10 = \2 per month. The full subscription price will be accounted for in the case of 5G media bundles.

FIXED WIRELESS ACCESS

This corresponds to the use of 5G for primary home internet access that also include a TV packages. Those services are delivered to the home via the cellular network as an alternative to fixed broadband technologies such as cable, fiber or DSL.

MOBILE DISPLAY ADVERTISING

This corresponds to advertising spend for static and moving images displayed on a screen delivered via the cellular network. Display advertising include in-stream and out-stream video advertising (e.g. YouTube, Facebook and Broadcaster services), in-game advertising, music streaming advertising, VR/AR advertising.

VIDEO

All type of paid for linear and non-linear audiovisual content including movies, TV series, sports, documentaries, reality TV and short-form videos like music videos. Subscription video on-demand services such as Netflix and Amazon Prime Video are included in this category. YouTube is excluded except for YouTube Premium.

MUSIC

This includes all type of paid-for professionally recorded music streamed or downloaded over 5G. It excludes the ad-funded portion of streaming services, digital radio and performance rights.

GAMES

All paid-for games downloaded through an application store to be played onto a 5G phone or a 5G tablet. It includes subscriptions, pay per downloads and in-app transactions. In-app advertising for games are excluded from this segment. It also excludes AR games and cloud gaming which are captured in separate categories in this forecast.

AUGMENTED REALITY

This refers to paid-for augmented reality applications on mobile devices and stand-alone augmented reality headsets or glasses. Augmented reality superimposes a computer-generated image on the top of the real world. Mixed reality, where the virtual world interact with the real world is considered a subset of this category.

VIRTUAL REALITY

This refers to paid-for virtual reality applications on dedicated standalone VR headset and smartphone-based VR also referred to as mobile VR. Virtual Reality is a computer-generated virtual 3D environment that the user can interact with.

CLOUD GAMING

This refers to games that are accessed remotely from a 5G device. The game mostly resides on a server away from the user's device.

ASSISTED/SELF-DRIVING IN-CAR ENTERTAINMENT

This refers to the consumption of media and entertainment services in assisted or self-driving cars at SAE level 3 or above. Revenues captured in this segment are based on revenue by car, and services may be shared among all passengers.

Ovum Consulting

We hope that this analysis will help you make informed and imaginative business decisions. If you have further requirements, Ovum's consulting team may be able to help you. For more information about Ovum's consulting capabilities, please contact us directly at consulting@ovum.com.

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Rob Gallagher

Rob Gallagher directs Ovum's global research on digital consumer services. He leads an international team spanning six research practices: broadband & multiplay; TV & video; digital media; digital communications & social networking; smart living; and consumer technology.

As a member of Ovum's research management team, Rob is also responsible for helping define and deliver on the company's overarching research agenda, product strategy, and long-term vision.

Rob began his career in 2000 as a journalist reporting on the then-nascent markets for internet access and e-commerce. Since joining us in 2003, he has led the expansion of the company's coverage of an ever-growing array of innovative consumer services and technologies.



Daryl Schoolar

Daryl Schoolar is a practice leader of Ovum's intelligent networks team, specializing in the mobile access network, and more specifically, technology and vendor trends around 2G, 3G, 4G (LTE), and 5G.

His research focuses on the radio access network (RAN) market, including traditional macro base stations, small cells, and carrier Wi-Fi. In these areas he closely follows LTE and 5G developments, as well as monitoring activities in 2G and 3G. Daryl's coverage also includes vendors and technology roadmaps.

Before joining Ovum, he was an analyst at Current Analysis and In-Stat. Daryl has also worked at Cable & Wireless in the US as a member of the market and competitive intelligence team.



Ronan de Renesse

Ronan de Renesse is practice leader for Consumer Technology at Ovum. He provides insight into mobile and portable device adoption, and the impact of new technologies on consumer trends. Ronan's research also covers analysis of the telecoms and media industry.

He has been analysing the telecoms and media industry since 2003. Prior to joining Ovum, Ronan was a lead analyst for Analysys Mason's mobile devices and digital economy team. He also previously worked for IHS Screen Digest covering the mobile sector.

Before becoming an industry analyst, Ronan was an academic researcher at the Centre for Telecommunications Research at King's College London. He holds a PhD in telecommunications from the same institution.



Ed Barton

Ed Barton is chief analyst of the entertainment practice at Ovum. His primary responsibilities include setting the research agenda and ensuring that the requirements of Ovum's extensive and diverse client base are continually fulfilled.

Ed and his team examine the most critical commercial issues challenging the media and entertainment industries, including emerging business models related to TV and OTT video; service provider evolution; and the ongoing impacts of innovation across content, devices, and networks.

He is a regular speaker on the conference circuit and is prized as a media and technology commentator, discussing a range of issues with CNN, Bloomberg, CNBC, Sky, and the BBC. He has been quoted by practically every English-language business news outlet, including *The Economist*, the *FT*, BBC News, and *The New York Times*.

Before joining Ovum, Ed led the digital media team at Strategy Analytics for three years, following a decade at Screen Digest (now IHS Technology) as a senior analyst.



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