



The Internet Value Chain 2022

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Executive Summary

This is an updated edition of the *Internet Value Chain* report, building on the internet value chain framework used in the previous report published in 2016. The report assesses the overall size of the value chain, key trends and dynamics playing out across it, and the economics of individual segments spanning content rights, online services, enabling technology, internet access connectivity and user interface, which includes hardware devices.

Since 2015 the internet has continued to grow at pace. There were over 4.6 billion users in 2020, representing 59% of the world population. However, there is much more to do to connect more people to what has become an entire economic system. In terms of commercial size, the revenues of the segments that make up the internet value chain were \$6.7 trillion in 2020, up from \$3.3 trillion in 2015. The strongest growth over that period has been in content rights (23% per annum, from a low base), and online services (19% p.a.), which now make up 57% of the entire value chain in terms of revenues. The enabling technology segment grew at 13%, and the internet access connectivity and user interface segments at 11% and 6%, respectively.

Growth of online services since 2015 has been driven on the consumer side by the emergence of many gig-economy services and consumers shifting more of their entertainment spend to online services, including online gaming and video streaming services, while search and social media services have continued to grow strongly. On the enterprise side, there has been a strong, ongoing migration of on-premise IT applications to cloud-based services.

The growth in entertainment has prompted increases in the activity and revenues of the content rights segment, with online video services paying more for exclusive television and movie content and the growing value of influencers creating content to reach their followers directly. Gaming content is also an active subsegment with the gaming platform companies increasingly investing directly.

The revenues of the enabling technology segment have also grown, offering more advanced services including the sophisticated advertising ecosystem and advanced, hyperscale infrastructure services

enabling more services to migrate online, and the expansion of payment gateways to support the ever-growing volume of internet transactions. Revenues of the internet access connectivity segment have grown at 11% per year since 2015 as more people and devices are connected to the internet, but all of this growth is a substitution for previously offline or private network services (e.g., voice, MPLS and VPN services). The user interface segment has grown at only 6% per annum in total revenue. While there has been growth in the volume of connected devices, including Smart TVs and smartphones, much of the growth has been at the value end, so average unit prices have declined.

In terms of overall value chain dynamics, we identify three key trends:

- The largest technology players are in the process of actively expanding their footprints across the value chain, launching new online services and using their scale and existing customer bases to drive success in new segments, and also integrating along the value chain, buying up content rights players and enabling technologies, and investing in end-user devices. Super-apps emerging in some Asian markets and metaverse developments are taking a similar direction of integrated platforms and ecosystems connecting users to online services.
- The majority of online services (61%) are paid-for rather than advertising-funded, with growth in gaming, subscription entertainment services and enterprise cloud-based services all driving growth. Advertising revenue growth continues to focus on search and social media services and ad-funded video services.

- There is a continued shift to online, as consumers spend more time and money online. The wider trend of digitalisation in government and enterprises as part of a major migration from stand-alone, on-premise IT stacks to cloud-based services is driving demand for services in segments across the value chain, from SaaS (software as a service) applications, to cloud platform services and the connectivity services that underpin these.

As these trends play out, a study of the economics of the subsegments shows that the returns are not equally distributed, since each subsegment has different underlying economics (e.g., capital intensity, scale factors, market concentration) and operates within different competition and regulatory frameworks. The online services and user interface segments are benefiting most from value-chain growth and generating the largest shareholder returns, whereas the internet access connectivity segment has generated relatively low and even single-digit returns on capital. Over the past six years, average total shareholder returns have been almost flat across the internet access connectivity segment, while other segments have at least doubled investors' stakes and some user interface players have delivered almost sixfold returns over the same period.

At a time when a greater load is being placed on internet connectivity infrastructure, requiring network operators to increase speed, capacity and coverage, their business model is being squeezed. First, enterprises are replacing high-margin MPLS and VPN services with more basic internet access services, resulting in an overall loss of revenue and margin for the operators. Second,

the scope of operator activities is being narrowed. As virtualisation of core network functions takes place, hyperscalers can develop and run these services at a global scale, playing a greater role in core service and network orchestration, while operators in many markets are separating their infrastructure (i.e., into fibre and tower companies) and selling selected assets. If these trends play out to their full extent, telecom operators risk becoming predominantly internet access providers, fulfilling the sales and service function but with significant capex requirements to build and maintain the access infrastructure.

In summary, although the internet value chain is growing strongly, the benefits and returns are flowing principally to players in the online services segment, while the telecom operators building and running the connectivity infrastructure which underpins these services are not benefitting as strongly as one might expect. Although the operators continue to invest in extraordinarily complex networks that enable the entire ecosystem, the low returns raise questions about the robustness of continued investment in capacity, coverage and speed of the networks to connect internet users with services. Business leaders and policymakers need to consider the interdependence of the many services making up the internet to ensure that market distortions, regulatory requirements or other factors do not limit the ability of participants across the internet ecosystem to make sufficient returns and that the right incentives are in place to promote the long-term growth of the value chain and to realise the full potential of technology and service innovation.

Introduction

The origin of the internet is often described as the effort to make interconnected networks created for government, academic and defence establishments more easily accessible to the wider public. While the initial building blocks of browsers and websites still exist, they have been surpassed to a large extent by other service types, including streaming and app-based services, that deliver content and interactions directly to end users on a broad array of devices. The internet now enables a multitude of applications running on IT systems hosted in the cloud, the digitalisation of large parts of the economy, and also government and citizen services.

What has remained constant is the need for an underlying infrastructure that connects all these services, however delivered, to end users. It is important to understand how well the internet value chain is working in terms of serving end users, promoting innovation and attracting investment to the areas that need it most. We first created the internet value chain structure as part of a report in 2010 looking at the value chain economics¹, which focussed on the relative size and returns of the different segments. Back then, the mobile internet was only nascent and smartphones were rare (the Apple iPhone 3G launched in June 2008, followed by the AppStore a month later). We updated the report in 2016², using the same framework to understand how the segments had evolved and found that, while online services continued to grow strongly, there were also signs of the internet economy maturing. There was a surprising lack of change between 2010 and 2016 in terms of the largest internet-based companies (11 of the most visited websites in 2010 were still in the top 15 in 2016). More recently, concerns about this concentration is leading regulators in many markets, including the US, Europe and Japan, to focus on the market

power of the key players and the possible barriers to competition in key segments of the internet.

With these significant changes in mind, the GSMA asked Kearney to prepare this third iteration of the internet value chain study to make it relevant for today's internet economy. Similar to the two previous papers, the objective of this report is to provide the framework, data and insight to inform the ongoing debate.

Although the scope of the paper is global, inevitably most of the examples and company financials used for the analysis are from the biggest markets, namely the United States, Western Europe and China, to provide the best macro view of the internet economy. There will of course be regional and national differences in how specific services are organised which go beyond the scope of this report. Full details of the methodology are included in the appendix.

Note on company names: For the purpose of this report, we refer to Google and Facebook, rather than their respective listed company names, Alphabet and Meta, as these mostly closely match the branding of the services we are discussing.

¹ <https://www.kearney.com/communications-media-technology/article?/a/Internet-value-chain-economics>
² The Internet Value Chain: A study on the economics of the Internet, www.gsma.com/publicpolicy

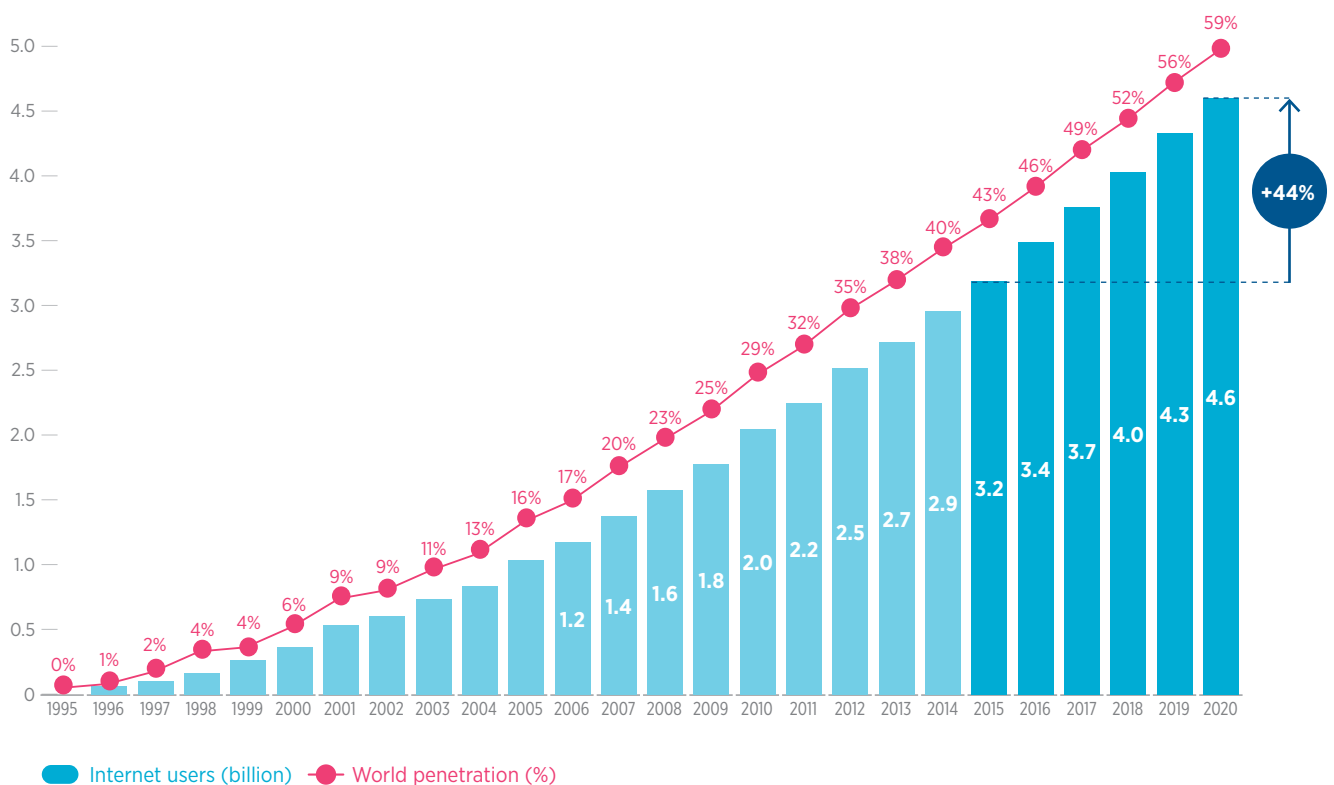
Internet Value Chain

Context

The internet continues to grow at pace in terms of users, services and, most of all, traffic. The growth is relentless, and there is much more to go. The number of people with access to the internet (Figure 1) has reached 4.6 billion in 2020 (via either fixed or mobile networks), an increase of 44% since 2015 and an annual growth rate of 7.5%. While this rate of growth shows no sign of slowing, 41% of the world's population still do not have regular access to the internet.

Figure 1.

Global internet penetration



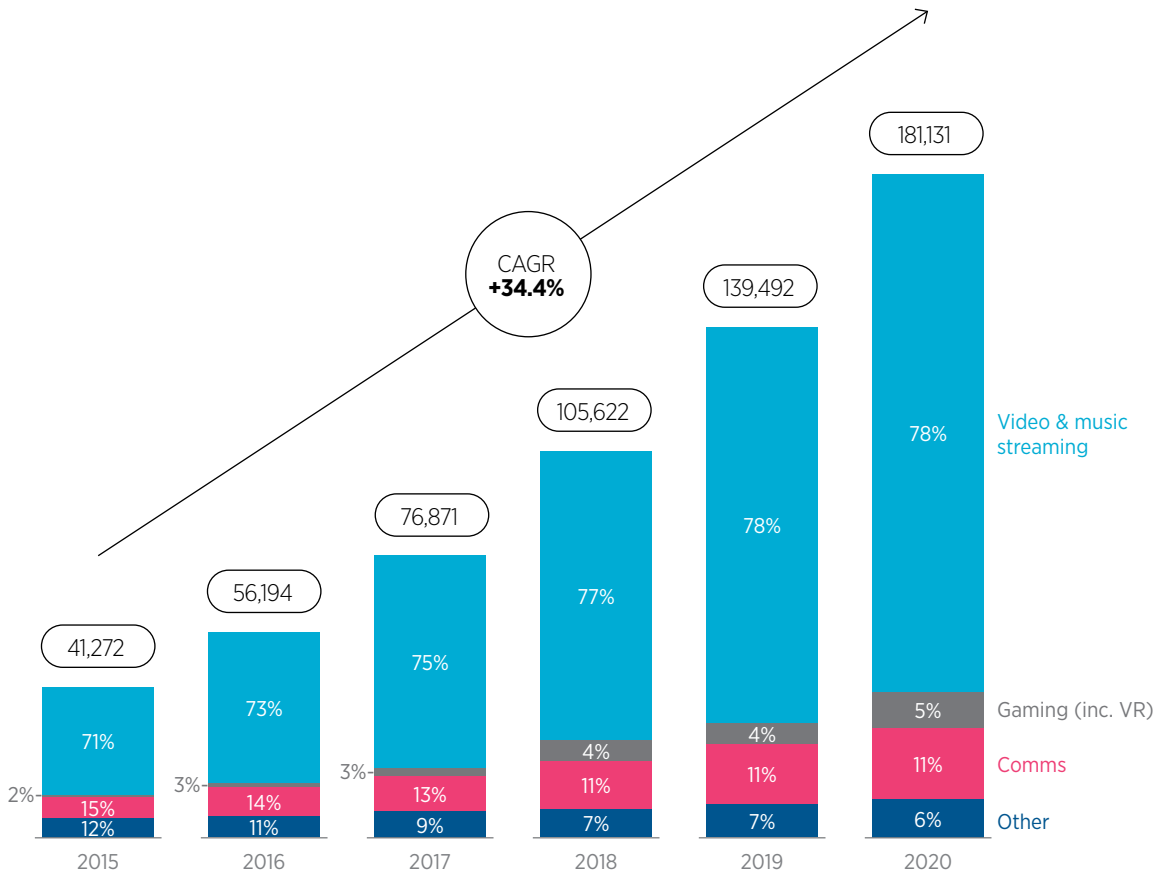
Source: Omdia, ITU, GSMA

Monthly traffic volumes (Figure 2) have been growing at 34% per year, which, after accounting for

growth in the number of users, represents traffic per user growth of around 27% every year.

Figure 2.

Global consumer internet traffic (average PB per month)



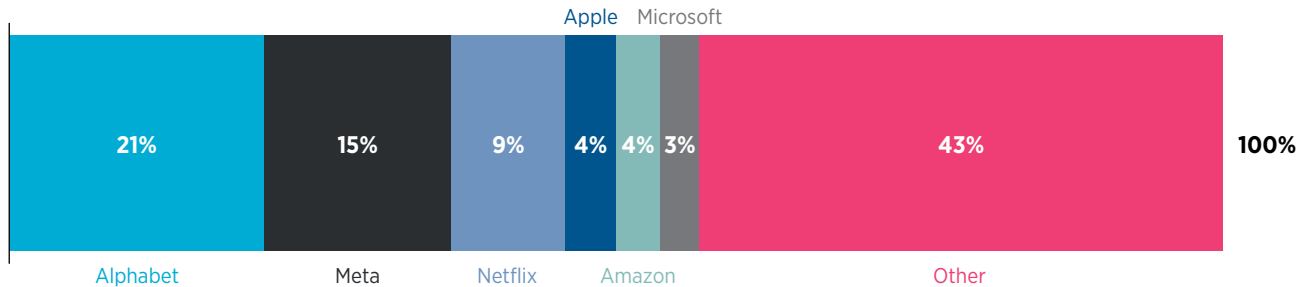
Source: Cisco, Omdia

The majority of that growth is coming from video and music streaming (of which 99% is video), driven by the growth in the number of subscribers and higher-quality devices (smartphones, tablets and smart TVs) with higher-speed networks enabling those users to consume greater quantities of content

at higher bitstream rates, allowing for higher-definition video. In absolute terms, communication services (primarily video calling via Microsoft Teams, Zoom etc.) and gaming are also contributing to the growth, making up 16% of total traffic.

Figure 3.

Global internet traffic by brand family



Source: Sandvine Global Internet Phenomena Report, January 2022

It is striking to note (Figure 3) that the combined traffic of six companies and their various services³ is more than all the rest combined.

Looking at 2020, internet infrastructure played a crucial role in the way individuals, enterprises and governments were able to respond to the Covid pandemic and lockdowns. Individuals were able to remain connected with friends and family when travel was not possible and to entertain themselves when everything else was closed. Many companies were able to continue operating with surprisingly little disruption when much of their workforce was confined to home. For students who could access the internet from home, schools were able to continue teaching remotely, while social media apps filled the gap in playground interaction for many children. Governments were able to mobilise a range

of tools in their efforts to mitigate and manage the impact of the pandemic, from contact tracing apps on smartphones to test results processing, vaccination programme roll-out and vaccine passports. While the social and human cost of Covid has clearly been significant, even severe in many respects, without the connectivity and the services it enables, the economic and social disruption caused by lockdowns would have been much greater. The internet infrastructure has been remarkably resilient despite the massive shift in usage patterns.

The next section looks in more detail at what has been happening over the past five years in each of the segments and subsegments and the many dynamics that are playing out across the value chain.

³ Meta includes Facebook, Instagram and WhatsApp, Alphabet includes Google search and YouTube etc.

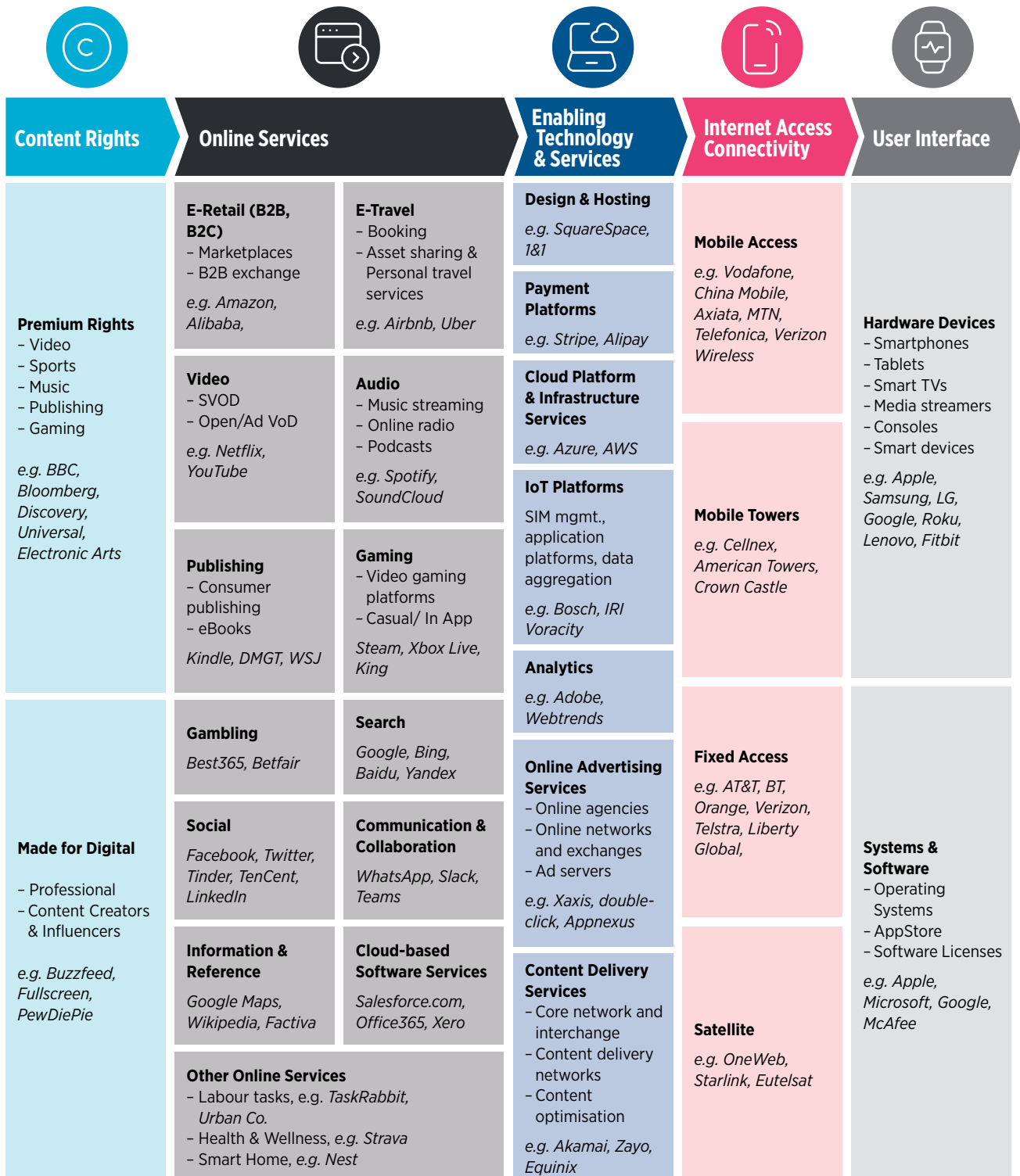
The Framework

Given the evolution of internet services, we have adapted the internet value chain framework used

in 2016 to capture the services that make up the internet ecosystem today (Figure 4).

Figure 4.

The internet value chain



Note that we use the term ‘value chain’ throughout this report in its broader sense to describe the framework shown in Figure 4, and we talk about the ‘value’ or ‘worth’ of segments and subsegments in terms of their global revenues. This differs from a stricter value-chain analysis, which would identify the specific value added at each step of making a product or providing a service. In practice, each of the segments within the internet value chain has its own value chain, such as the chain to build end-user devices from plastic, metal and silicon, or the telecom equipment supply chain, or even the movie industry supply chain to make some of the content distributed via the internet.

The logic remains the same as that used in 2016, in terms of representing all the players involved in the end-to-end service experienced by people using the internet. We have retained the five main segments — content rights, online services, enabling technology and services, connectivity and user interface — which are divided into 28 sub-categories. We have sought to keep to the 2016 framework as much as possible, but where we have added new subsegments or refined definitions, we have restated the comparable 2015 numbers to align with the new framework and to ensure like-for-like comparisons. As such, some of the subsegment level definitions and figures presented here are not directly comparable to those used in the 2016 report. Further details are included in the methodology section at the end of this report.

Key differences with the 2016 report are:

- Cloud services — In 2016, this was captured within the online services segment. It is now split, with cloud-based software services (i.e. SaaS and other hosted services) in online services and a new subsegment named cloud platform and infrastructure services (i.e. platform-as-a-service, infrastructure-as-a-service, etc.) within the enabling technology and services segment. This reflects the growth of these services and the fact that many are a means of providing end-services rather than end-services in their own right.
- Mobile towers — The mobile connectivity subsegment is now split into service operators and mobile tower companies to reflect the restructuring that is taking place in many markets.

We have revised the definitions of several other sub-categories, which are mentioned in the relevant sections below.

In the 2016 report, the distinction between business and consumer services was removed as it was becoming blurred and many services were already being used for both purposes. That trend has continued and now many, if not most, online services are used by businesses and consumers, although some are more oriented to one audience than the other. A separate challenge we have addressed in the methodology is defining what is actually online versus offline. Our methodology is based on the ‘online share’ of any given service. In retail, for example, Amazon is clearly an online retailer, and high-street retailers were once referred to as ‘bricks and mortar’ enterprises. Now however, many online purchases are made via the websites of high-street retailers and may be fulfilled at a physical store. Similarly, in content rights, films or sports event rights would be sold to TV channels (often pay TV) and online rights were a secondary consideration. Now online content rights are frequently sold as an independent package, separate from broadcast or other distribution rights, and online may even be the primary distribution channel for some content, including for certain major films or sports with a dedicated online channel. In many cases, the growth in the online services segment is due to this transition from offline to online, not necessarily absolute organic growth.

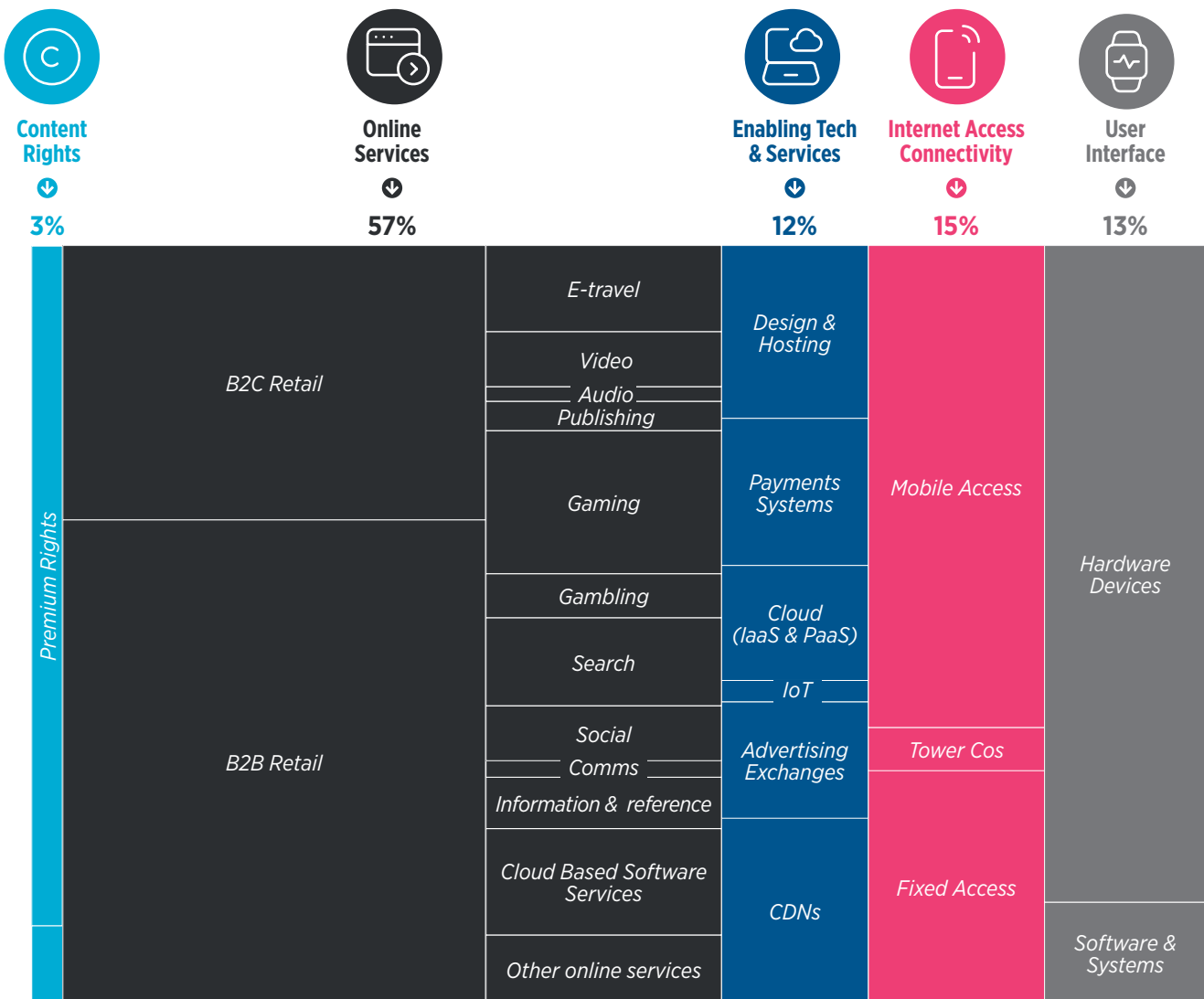
Overall Valuation

Using the framework described above, we have quantified the overall size of the internet value chain based on the 2020 revenues of each of the subsegments⁴. Based on this approach, the total revenue of the internet value chain in 2020 was \$6.7 trillion globally. As can be seen in Figure 5, the online

services segment generates over half of this revenue, user interface 14%, internet access connectivity 15%, and enabling technology and content rights generate the remainder. In the following sections we look at the scope, size and dynamics of each segment.

Figure 5.

Internet value chain valuation 2020



Made for Digital

⁴ 2019 data has been used in a few cases where 2020 would be materially distorted by the pandemic impact, e.g., e-travel. These exceptions are noted in the detailed descriptions below.



1. Content Rights

Content rights covers the services of individuals and companies that acquire the commercial property rights to distribute content via the internet and then monetise these rights by selling the content across a range of internet platforms and services. The overall content rights segment had revenues of \$186 billion in 2020, making up just 3% of the overall value chain, up from 2% in 2015. Although relatively small, the segment has grown at 23% per annum over the past five years.

We have split this segment into two main types of content rights:

- Premium internet rights.** These are rights to distribute various types of premium content such as sport, music and entertainment via internet-based delivery platforms including subscription and on-demand services. These rights generated \$167 billion in 2020, having grown at 21% per year since 2015. Six years ago, most professional rights, whether for sports, music, films, TV box sets, etc., were created primarily for offline channels and may have had a ‘tiered’ distribution sequence, starting with cinema, then physical DVD, then Pay TV and finally free-to-air broadcast. The right to distribute such content online was treated as an add-on generating additional revenue. This situation has now reversed in some cases, as the content budgets of online services such as Netflix and Amazon (over \$20 billion⁵ between them in 2019) enable them to commission original content that goes directly online on first release. In fact, in 2019 Netflix was the second largest player in the total entertainment content market (online and offline, excluding sports rights) according to broker RBC Capital Markets⁶, with 18% of the market, second only to Disney. Amazon’s acquisition of MGM studios for \$8.5 billion in 2021
- Made for digital rights.** These are rights to the content specifically created for the internet (often by the creators directly), such as YouTube channels and videos as well as ‘influencers’ creating content for their followers across a range of platforms, including social media. This segment encompasses aspiring amateur content through to professionally written and produced channels with millions of subscribers or followers. The global reach of the internet enables creators of niche content to connect with an audience made up of relatively small numbers of geographically dispersed readers, viewers or listeners with a common interest, therefore making such content viable. From a low base, we estimate this segment’s revenues have grown at around 45% per annum since 2015 to be worth \$18 billion in 2020. Since 2015, the commercial mechanisms to incentivise and reward the creators through a share of revenue from the platforms hosting the content (whether subscription-based or advertising-based) have developed significantly. These commercial models are supported by the emergence of a sophisticated marketing ecosystem that connects brands with creators to enable direct sponsorship using product placement and endorsements. As a result, in 2020, top-earning YouTubers are reported to earn over \$20m per year, and celebrities such as footballer Cristiano Ronaldo are reported to charge up to \$1.6m⁷ for a sponsored Instagram post. Even non-celebrity influencers can earn over \$100,000 through sponsored posts.

⁵ Company reports and announcements

⁶ RBC Capital Markets — Bring on the Bandwidth: A Primer on Wireless/Broadband/Video — 15th Jan 2019

⁷ HopperHQ.com



2. Online Services

The online services segment is made up of services that most users would consider to be ‘the internet’, since it includes social media platforms, online retail stores, the many websites and information services that are available, and the services accessed via apps on a smartphone. It includes digital services that may be delivered and consumed over the internet (e.g., music streaming or social media services), and also non-digital goods and services transacted over the internet but consumed offline (e.g., physical products bought online, accommodation and

travel services booked online). It also includes the many B2B services that companies use, such as cloud-based software applications covering ERP, accounting, procurement portals, etc., and is also where all the internet advertising is served up to end users as banner ads, search results and in-app adverts.

There is a very wide range of services available via the internet, and so for the purpose of this report and analysis we group them into five clusters.



E-COMMERCE

E-commerce services cover both the e-retail and e-travel segments, where the actual goods and services purchased are very much ‘real-world’ rather than online services in their own right. Without the internet, the purchases would in most cases be conducted through a different channel (albeit in a more time-consuming and less transparent way, from the user’s perspective). To account for this, and consistent with previous reports, when sizing and valuing these segments we only take into account the margin earned on the transactions by the retailers, not the gross value of transactions carried out via these services.

- **E-retail.** This includes all companies and marketplace sites that sell goods and services online, either to consumers or businesses. Any service where a sales transaction can be made online is included, whether directly with a retail site or via an intermediary marketplace (e.g., eBay) and even if the fulfilment takes place offline (such as click-and-collect services of high-street retailers). Dedicated B2B retail exchanges are also included in this subsegment. Since 2015, when e-retail margins were almost \$1tn, they have continued to grow at 19% per annum and are now worth \$2.3tn. This growth has been driven by a mix of the pure online retailers including Amazon, Alibaba and TenCent and many more local specialists, as well as many high-street retailers growing and enhancing their online channels. While in 2010, and to some extent still in 2015, we could think of online retailers as a separate category to ‘bricks-and-mortar’ shops,

the distinction is very much blurred now. Almost all high-street shops will have an online shop, and although Amazon may be considered a pure online player, it has a very large real-world supply-chain network involving more people, warehousing and delivery vehicles than most shop chains.

- **E-travel.** This includes online travel booking sites and travel agency services (e.g., Expedia, booking.com, direct purchases via airlines’ own websites, and travel apps), as well as newer online ride-hailing or ride-sharing services such as Uber, DiDi, and BlaBlaCar, and other tourism/hospitality sharing-economy services such as Airbnb. Before the pandemic, the e-travel sector was growing at 24% per annum, with margins growing to be worth \$164 billion in 2019, following a similar transition from offline to online becoming the primary booking channel, whether booking via an agency, aggregator or direct with the travel provider such as airline or hotel websites. Personal transport and asset-sharing services such as Uber, Lyft, Airbnb, and local equivalent services have also driven growth in this sector by creating new markets and services that increase the size of the sector overall. These services made up around 25% of the e-travel subsegment in 2019.

In 2020, all sectors were affected in some way by changing behaviours and economic activity due to Covid. While the actual impact will only be visible when subsequent years’ data can be used to re-establish trend lines, the travel sector was one of

the hardest hit, and so to avoid a major distortion in the data, we used 2019 figures for the e-travel subsegment. The e-retail sector was almost certainly a beneficiary in many countries where high-street

outlets were closed for extensive periods, and so it is yet to be seen if this boost will be sustained by a more permanent shift to online purchasing.

ENTERTAINMENT

Many of the services people access and consume via the internet are entertainment-related. Many traditional products (tangible items) have been transformed into digital products and services that are delivered online (e.g., CDs and DVDs transformed into streaming services), providing a new and enhanced distribution channel for services that would otherwise have been enjoyed offline (remember that Netflix started as a DVD rental-by-post service). This has also facilitated a shift from the outright purchase of tangible or non-digital items (e.g., music CDs, DVDs) to a more subscription-based service model, especially for video and music. Similar subscription services exist for books but have not been adopted so widely (perhaps ironically, given that public libraries have been offering a physical version of such a service in many countries, often for free, for over a century).

- Video.** This includes services that distribute video content and are closely linked to the premium rights subsegment of content rights. The revenues of the video subsegment were \$105 billion in 2020, having grown at 23% per year since 2015. Up to 2015, these services were generally an alternative distribution channel for content that was primarily created for offline consumption (e.g., at a cinema, pay TV, DVD sales or movie channels), but the large growth, and therefore budgets, of players in this subsegment has resulted in these platforms commissioning their own content directly, e.g., Netflix (blockbuster films and TV series box sets). Growth has also been driven by the wide availability of high-speed internet access (either high-quality fixed or 4G mobile) and adoption of smart TVs and larger-format smartphones with high-quality screens. YouTube and other broad access platforms have also improved the monetisation of their services, primarily through advertising, which has led to a virtuous circle of more professional content driving further growth. YouTube has now reached the point where it offers a subscription option to remove adverts, which could be an area of future growth if consumers prove willing to pay.
- Audio.** This includes services distributing music and spoken-word content (primarily podcasts) either via streaming or downloads of purchases. As well as global streaming giants like Spotify, Tidal and Amazon music, the subsegment also includes internet-based radio stations. This subsegment has grown the fastest of the entertainment services, 25% per year, reaching revenues of \$26 billion in 2020, driven by the continued expansion of streaming services and the near total demise of physical distribution of these services in mature markets (except for vinyl record sales, which now exceed the value of CD sales in the US and other markets). In 2015, streaming services were widely available (both ad-funded and subscription-based), while services such as Apple's iTunes offered downloads for purchase. Since then, the market has moved much further to subscription-based streaming rather than 'buy and download', and Apple has launched its own streaming service, Apple Music.
- Publishing.** This includes the online equivalent of newspapers, magazines and books. Far more than being a new way to distribute the written word, online publishing services offer a rich experience of multimedia content, with embedded video, links to supporting materials, and other valuable features such as advanced search. Examples include dedicated online sites (e.g., HuffPost and BuzzFeed), the online properties of traditional publishers (e.g., ft.com) and e-books. Services may be ad-funded and free to access, fully subscription-based or a blend of the two. Publishing has seen the slowest growth rate of just 8% per annum, but it is still a significant subsegment with revenues of \$58 billion in 2020.
- Gaming.** This includes platform-based video gaming with an internet connection (Xbox Live), casual online games (e.g., Candy Crush), 'massively multiplayer' online games (e.g., Fortnite) that use the internet to connect thousands of users around the world simultaneously within a single game, as well as online digital purchases that are downloaded to consoles or PCs. Users may access the services

using various devices, including gaming consoles, smartphones, tablets and PCs, and revenues are generated via subscription fees, in-game purchases and advertising. The purchase of consoles or hardware is accounted for in the user interface segment. Gaming is the largest subsegment in absolute terms, with revenues of \$272 billion, but it has grown more steadily at 16% per annum, driven in particular by the rise of free-to-play games with in-app purchases or adverts, and also the steady growth of online gaming platform subscription revenues (e.g., Xbox live, NVIDIA Geforce Now).

- **Gambling.** This is a subsegment that continues to grow online, despite restrictions in some countries. Besides being a new channel for traditional bookmakers, the internet has enabled a new form of gambling with exchange platforms allowing customers to offer odds as well as place bets with one another and to also gamble on casino games such as roulette, poker and slot machines. As with e-retail, for this subsegment, we capture the gambling service providers' take, not the gross amount wagered or paid out. Gambling revenues are worth a further \$83 billion and have grown at a similar rate of 13% per annum over the past five years.



SEARCH, INFORMATION AND REFERENCE SERVICES

One of the major benefits the internet has brought to society is making a vast array of information readily available to a large proportion of the global population. This segment of the internet value chain includes the original information sources and the search tools used to find and access them.

- **Search services.** This includes global search engines such as Google and Bing and regional ones such as Baidu and Yandex. They are often the first entry point to finding the exact information or service a user needs. These services are almost entirely funded by advertising and are thus free for users to access. Search revenues amounted to \$168 billion in 2020 and have grown at around 14% per year since 2015.
- **Information and reference services.** This covers a very broad range of information sources, including factual reference services, such as the Wikipedia services, as well as dynamic real-time information such as traffic and transport status

available in Google Maps, Flightradar and Waze. These services are funded through a combination of commercial (usually advertising, sometimes subscription) sources as well as donations and voluntary funding. Many sources of information are also made open and available online by state agencies and commercial organisations, such as academic papers, national archives, statistics and financial data. Online B2B information services such as Bloomberg, Refinitiv Eikon and Dow Jones Factiva also fall into this subsegment. Worth \$99 billion in 2020, revenues from these services are substantial but have only been growing at 5% per annum since 2015, showing the challenge that information providers have faced since the early days of the internet of monetising information in a world where many providers make it available for free (often in exchange for data gathered from users of the services or as a loss leader to attract users to a platform with additional services or ad-placement opportunities).



SOCIAL MEDIA AND COMMUNICATIONS

These services are among the largest on the internet in terms of the number of users and the volume of interactions.

- **Social Media.** This includes the major social media platforms including Facebook, Instagram, Twitter, TikTok and the professional network LinkedIn. Online dating services as well as more specialised

or local services such as Nextdoor local community forums are also included, although the revenues of the smaller services are dwarfed by the few major players, highlighting the network effects of those services. A recently published study by AppAnnie⁸ found that consumers were using their mobile phones four to five hours

8 State of Mobile 2022, appannie.com

per day across the major markets, and around 40% of this time was spent on social media and communication apps and a further 30% was spent on photo and video apps including YouTube and TikTok. As a consequence, these services have continued to grow strongly (almost exclusively advertising driven, except for LinkedIn and dating services), based on more sophisticated analytics enabling micro-targeting of adverts (which is attractive and valuable from an advertiser's perspective), and revenues have grown at 27% per annum since 2015 to be worth \$107 billion in 2020. In the context of the full value chain, this amount is rather modest and much less than users and investors seem to perceive these services to have, although the power of network effects and the depth of data these platforms can gather on their users gives them strong potential growth opportunities.

- **Communication and collaboration services.** This includes the various internet-based messaging platforms and collaboration tools, such as Slack and Microsoft Teams. Although consumer internet connectivity originally grew as an

add-on to telecoms networks that were built primarily for voice communication (copper lines for fixed networks and 2G mobile networks), internet-based communications services are increasingly becoming default services for direct communications. These services are remote platform-based, detached from the physical telecom networks, and not tied to a tangible phone number or SIM card. Leading examples include internet protocol-based (IP-based) communications services WhatsApp, Signal, Telegram and WeChat, and B2B unified communications services such as Cisco HUCS and Jabber. The combined revenues of this subsegment were \$30 billion in 2020, having grown at around 9% per annum since 2015. Although the basic messaging services are generally free for consumers, platforms are able to generate revenue through in-app features such as stickers, advertising and margins on payments transacted through platforms. Enterprise services include subscriptions for collaboration tools and IP communications services, as well as paid connections to traditional phone networks.



CLLOUD-BASED SOFTWARE SERVICES AND OTHER E-SERVICES

The final category of online services is made up of end-user cloud-based services.

- **Cloud-based software services.** This includes services hosted and run on remote data centres and accessed via the internet by users around the world. The services include data storage and back-up for consumers, e.g., Google Drive, Microsoft OneDrive and a wide range of hosted enterprise software and business services. Software-as-a-service (SaaS) applications replace software that previously may have been purchased and installed on an end user's PC or in an enterprise's own data centre but are now accessed via a web-browser, e.g., Xero accounting and Salesforce.com. We also include the more advanced business-process-as-a-service (BPaaS) services here, which go beyond cloud-based software services and include an element of human intervention. This subsegment had revenues of \$203 billion in 2020 and has grown at 45% per annum since 2015. These cloud-based services have also expanded the overall market by making many of these types of services and applications available to small companies

that may once have purchased off-the-shelf applications or even done tasks manually, such as bookkeeping, stock-taking and financial returns.

Since the 2016 edition of this report, this subsegment has grown in size and sophistication. We have moved the cloud-based platform and infrastructure services such as on-demand data processing power, advanced analytics, e.g., Amazon Web Services (AWS), which are used to host and enable online services (but are not generally online services in their own right) to the enabling technology subsegment and have restated the 2015 numbers for both to align with this updated definition.

- **Other e-services.** This includes user-paid services such as e-learning, health and fitness services, smart-home service subscriptions (excluding device purchases), and labour and maintenance services such as TaskRabbit and Urban Company. These services are a combination of services that would have happened without the internet, but internet platforms have been able to match

suppliers with customers more efficiently and grow the subsegment and incorporate new services that provide analytics and comparisons that previously would not have been possible, e.g., Strava. As a subsegment, service revenues have grown to \$131 billion in 2020 driven strongly by e-learning services.

When combined, the online services segment is by far the largest of the five in the value chain framework, with \$3.8 trillion in revenues. It is also the main driver of growth in absolute terms, growing at 19% per annum since 2015. Only the much smaller content rights segment grew slightly faster, at 23%.



3. Enabling Technology and Services

The enabling technology and services segment covers a wide range of services, often niche, that are generally not visible to internet users but are essential to the efficient operation of the overall internet infrastructure and provide much of the technology that supports the online services segment. It covers many of the cloud-based infrastructure and platform services that host online services, the payment gateway services that enable e-commerce, advertising intermediary exchanges that serve tailored adverts to users on websites and apps, and Internet of Things (IoT) platforms that enable the collection and processing of data from the plethora of connected devices.

The overall segment revenues have almost doubled in size from \$442 billion in 2015 to \$812 billion in 2020, representing an annualised growth rate of 13%. This is slightly below the overall internet value chain growth rate of 15% which is being driven by the continued above-trend growth of the online services segment. The enabling technology segment growth correlates strongly with this but does not scale directly with the online services segment because many services are based on a per transaction, per click, per user basis rather than in line with the transaction value of e-commerce, advertising, etc. It is also true that competition between companies in the various subsegments has led to unit price pressure, multiple payment gateway providers, online-focused ad agencies, etc.

- **Design and hosting.** This includes sites that incorporate design services, templates and managed hosting to facilitate updating, tracking and usage reporting. Although the design and hosting of websites is a fairly basic building block and has only grown at 8% per annum since 2015, the sheer volume of websites mean it is still a large subsegment with \$185 billion in revenues in 2020.
- **Online payment gateways and e-wallets.** This includes the services that integrate with online services to enable payment transactions to be processed, e.g., e-commerce transactions, subscription processing, etc. In many countries, the default method of payment is a credit or debit card, but in locations where such cards are less widely adopted, e-wallet services have sprung up to enable online transactions. Such services include PayPal, Paytm and Stripe, and revenues have grown rapidly over the past five years to reach \$159 billion in 2020. In valuing this subsegment's revenues, we have used the platform or service providers' transaction fees (typically 1-4%), not the gross value of transactions they process.
- **Cloud-based infrastructure and platform services.** This covers the cloud-based infrastructure services offered by the large infrastructure platforms such as Microsoft Azure, Google Cloud Platform, AWS, Alibaba and TenCent, which make up a large part of the global market, although there are smaller national and regional players. In 2015, these services were included within 'cloud' as part of the online services segment, but as they have grown in size and sophistication, we have added infrastructure and platform services as a subsegment within the enabling technology segment. Infrastructure and platform subsegment revenues have grown rapidly, at 31% per annum since 2015, to reach \$123 billion in 2020, as enterprises migrate large portions of their IT application estate from private data centres to public-cloud-based infrastructure.
- **Internet of Things.** This includes the integration, management and operation of platforms that collect and process data from IoT type connected devices and also the management of them. Most of the value is in the development and provision of

IoT applications and solutions, which are generally bespoke solutions integrating hardware with end-devices and the complex IT stacks to make use of the data and two-way communication. There is considerable innovation and use cases for IoT are still emerging, including connected-car services and real-time managed fleet solutions. This subsegment has grown at 16% per annum, faster than many other enabling services, to reach \$20 billion in 2020. The value for the subsegment does not include the connectivity between devices nor the end-user services.

- **Online advertising services.** This includes the enabling platforms, technology and exchanges that underpin the online advertising ecosystem (but not the actual media spend on the adverts themselves, which fund the online services). When a simple banner advert appears on a website, within an app or in a social-media feed, it is often the result of a complex and almost instantaneous chain of transactions that takes place behind the scenes involving advertising networks, online agencies and exchanges to determine which user should see which advert and then place the advert accordingly. The combined value of such services has grown from \$84 billion in 2015 to \$125 billion in 2020, an annual growth rate of 8%. This relatively low growth rate is partly due to the value of this subsegment being linked to the volume of transactions rather than the absolute

value of the advertising spend being transacted. It is also likely that a greater proportion of this business is being served directly by the large platforms such as Facebook or Google, thus circumventing the discrete services captured here and limiting the growth of the intermediary services.

- **Content delivery services.** This covers services that help ensure the smooth interconnection and delivery of traffic and content across the internet, regardless of source or destination. While there are specialist suppliers such as Akamai, these services are increasingly integrated into cloud-based IaaS (infrastructure as a service) and PaaS (platform as a service) services to ensure the quality of access to the cloud services. The providers of these services are major investors in, and direct buyers of, long-distance, international and sub-sea communications capacity, which was previously the domain of the telecom operators. However, there is no direct link between the commercial value of traffic and the volume. So, while still critical to the internet infrastructure, this subsegment's revenues have only grown at around 10% per year since 2015, to reach \$198 billion in 2020. It is also a fiercely competitive subsegment that has been able to deliver year-on-year gains in efficiency resulting in unit prices falling to offset the increase in traffic volume.



4. Internet Access Connectivity

The internet connectivity access segment covers the services end-users pay for in order to connect to and access the internet. For most users this takes the form of either a fixed connection such as a fibre broadband or cable connection (most likely with a Wi-Fi hub) in their home, or a radio-based mobile network service, and many users seamlessly switch between the two. Of people with internet access, around 40% use mobile only, while the remainder have access to both fixed and mobile.

In the two previous reports, on the consumer side, we allocated only that portion of total customer spend related to internet connectivity as opposed to traditional person-to-person communication. At the time of previous reports, many mobile operators reported a split between voice, SMS and data

revenues and fixed operators reported voice and data revenues (though line rental charges support both services). These splits were always somewhat artificial given that consumers buy a service bundle for a set price, but made sense for analysis purposes in 2016. In 2020, this split made less sense and we have taken the view that all consumer revenues are internet related. For fixed-network business services we continue to take public internet service revenues and exclude private network services that do not use the public internet infrastructure, such as MPLS and PSTN voice services.

- **Mobile access.** This includes mobile service revenues only and excludes any payment for handsets (although users will often buy a handset and service contract in a single transaction). In

most cases, the main suppliers of these services are mobile network providers (such as Vodafone, Verizon Wireless and China Mobile), but end users may actually buy services from a range of mobile virtual network operators (MVNOs) who are reselling connections and capacity on these networks in any given country.

- **Mobile tower.** This covers independent mobile tower companies that provide services to multiple operators, a subsegment added since the 2016 report. The subsegment is growing rapidly as many operators realise the value-generation potential of these assets, carve them out, drive multi-tenancy and invite investors or sell them to large tower companies. To avoid double counting, we have subtracted the revenue value of this subsegment from the mobile access subsegment because payments flow between the two. The value of the whole mobile access subsegment is the combination of the two.
- **Fixed access.** This covers the revenues attributed to internet access services that could be delivered to end users over a range of access technologies such as DSL, cable (DOCSIS), direct fibre and public Wi-Fi. In most countries, the main suppliers are the former incumbent telecoms operator and a range of newer alternative network operators, either using their own networks (such as cable operators) or using unbundled local loops from the former incumbent connected to their own core and aggregation networks. In many markets, the investment in upgrading copper-based networks to full fibre is resulting in the emergence of alternative fibre network operators, analogous to the split of mobile tower assets from the operators. In fixed networks, the split is less clearly defined, with fibre companies using a range of commercial models. Some are wholesale-only and rent lines and capacity to the operators, but others have a mixed wholesale and direct retail model or direct retail. It is therefore harder to delineate the services and value them separately. Regardless of the model, the full value

of the subsegment is captured here in terms of consumer revenues.

- **Satellite.** This covers the services offering internet access via low Earth orbit satellites, e.g., Starlink and OneWeb, but these services, while growing and generating a lot of attention currently, are very small in absolute revenue terms when compared to global fixed and mobile telecom revenues, and are likely to remain so even in the mid- to long-term.

Overall, the total global telecoms sector (including non-internet-related services) has been roughly flat since 2015⁹, with mobile growth offsetting a slow decline in fixed revenues in most regions. However, a much greater proportion of this revenue is related to accessing the internet and a decreasing proportion to other forms of communication, primarily voice calls and private enterprise data networks. The internet-related portion of the revenue we attribute to the value chain has therefore increased from \$585 billion in 2015 to \$988 billion in 2020, a growth rate of 11%. On the consumer side, this growth is mainly driven by increased spending on internet services, partly substituting spend on the non-internet-related services, as well as steady growth in the overall penetration of internet services of around 7.5% per annum. Similarly on the business side, there is an ongoing shift from private data-network services such as MPLS and Ethernet VPN to public internet-based services using SDN technology to create VPNs.

But, with the transition to internet almost fully complete on the consumer side, we expect this growth rate to slow in future. The business services transition from private infrastructure to public is still ongoing and will also sustain some growth in public internet related revenues but, as we discuss in the later section [*The two-sided squeeze on the internet access connectivity segment players*], this transition results in lower overall revenues and margins for the telecom operators.



5. User Interface

The final segment of the internet value chain, user interface, is the most tangible from a user perspective and includes the devices, systems and software used to access the internet and the services in the other segments. Over the history of the internet, there has been a steady stream of innovation to enable people and machines to be connected to the internet in a greater variety of ways. While a smartphone or web browser on a PC may still be the most common access mechanism,

many more devices such as smart TVs, home appliances and cars are now connected and used to access internet-based services. Often users are not even aware that they are using an internet service, for example when giving a voice command to a smart-home device or accessing the help menu on a desktop application. We split this segment into devices (which may include embedded software and operating systems) and standalone software when sold or valued separately to the device it runs on.



HARDWARE DEVICES

As mentioned above, smartphones and PCs are by far the most common devices used to access the internet, making up 43% and 26% of the value of this subsegment, respectively. However, there is also a long and growing tail of other devices used to connect to specific services on the internet. Most new televisions are 'smart' in the sense that they come with the means to connect to the internet to access streaming services, which are built into the menu options (and there are even models launching now that do not include an RF tuner). Many smart TV manufacturers are using Android TV as the platform, which enables the streaming services to be accessed as apps. Streaming media devices such as Amazon Fire Stick and Roku streaming players can also be connected to televisions to access additional internet-based services and content or are integrated into devices such as Sky Glass (effectively a TV with the set-top-box of the pay-TV service fully integrated). Smart home devices and appliances, including security cameras, doorbells, fridges and light switches are also becoming more common and depend on the internet infrastructure

for their functionality. Game consoles such as the Xbox, PlayStation and Switch, while possible to play offline, are designed to be connected to the internet to enable multiplayer games, additional game content, game downloads and updates, and can also act as access devices for entertainment services via downloadable apps.

The devices subsegment was worth \$778 billion in 2020, up from \$605 billion in 2015, driven by continued growth in smartphone sales (2% per annum) and smart TVs (18% per annum). PCs and tablets together make up 33% of the subsegment but have only been growing at 4% per annum as penetration plateaus and, in the case of tablets, smartphone size and functionality have increased to provide an attractive alternative. Wearables such as watches and VR/AR headsets are also a fast-growing subsegment (28% per annum). The emergence of the metaverse may result in these being much more commonly used internet access devices at some point in the future but at present they make up only 3% of the subsegment.



SYSTEMS AND SOFTWARE

This subsegment includes operating systems, app stores and security and internet-related software when they are purchased on a standalone basis, i.e., not embedded within an end-user device, and are for the purpose of or to support accessing the internet. It includes security applications such as VPN and anti-virus software, as well as professional-grade B2B endpoint and network security provided by

companies such as Cisco, VMware and Juniper. Particularly on the consumer side, there has been a steady evolution away from one-off purchases of specific products and versions to subscription-based services with frequent upgrades over their lifecycle, with the Microsoft Office suite being the obvious example. In fact, even in 2017, Microsoft disclosed that recurring subscription revenues for their

Office 365 suite of software were higher than the traditional license sales for Office.

Overall, this subsegment has grown at 17% per annum, from \$55 billion in 2015 to \$11 billion in 2020. App stores have grown rapidly at 20% per annum, driven by in-app purchase models and the massive growth of games such as Fortnite. The security software subsegment has grown equally strongly,

from \$24 billion in 2015 to \$61 billion in 2020 (21% per annum), as enterprises in particular make greater use of public-internet-based services such as cloud infrastructure and internet VPNs to replace what had previously been private infrastructure, and adopt security applications to enable this. The operating systems subsegment has been almost flat (4% per annum), aligned with PC growth rates.

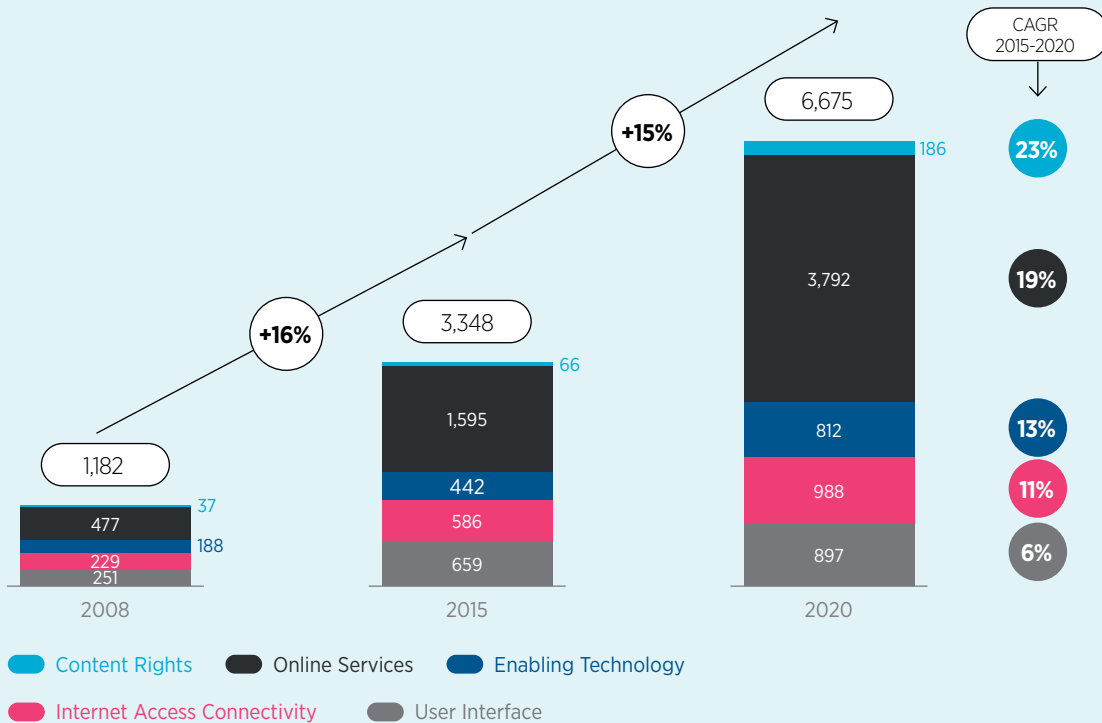
Value-Chain Dynamics

The sustained growth trajectory of the internet value chain is evident when comparing current data with that of 2008 and 2016, showing overall growth of 15%-16% per annum over 12 years and bringing the total value to \$6.7 trillion in 2020 (Figure 6).

Figure 6.

Segment growth rates

\$ billion



Note: 2015 data restated where category definitions updated in 2020. 2008 totals scaled to align with revised 2015 total
Source: Kearney, CapitalIQ



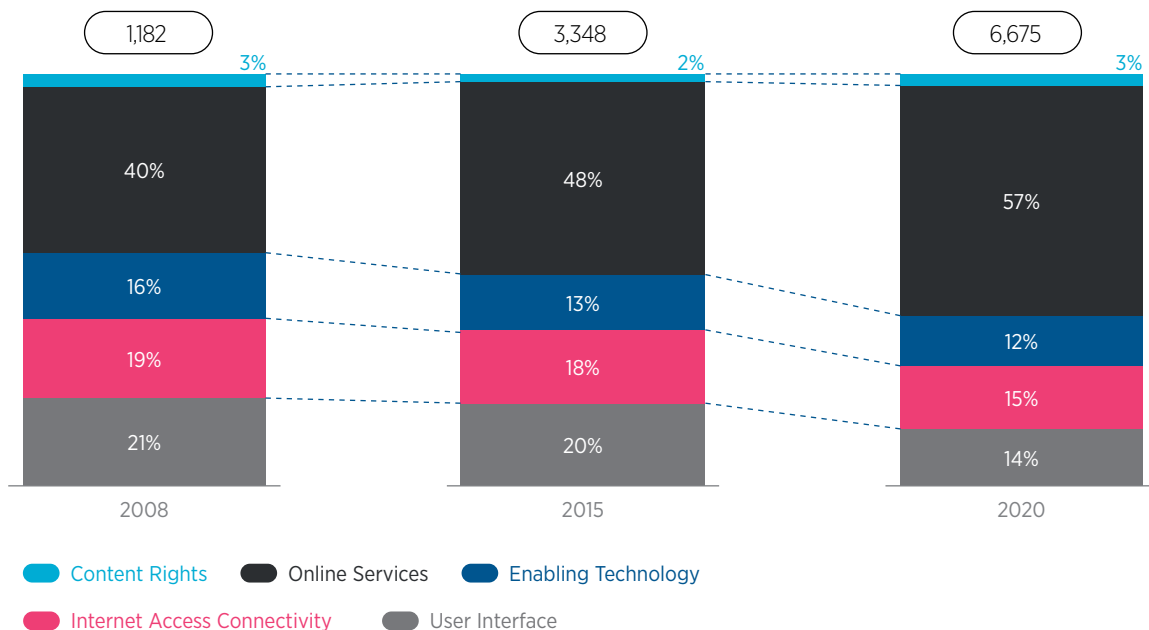
Much of this growth has been driven by the largest segment, online services, growing at 19% per year and the much smaller content rights segment growing at 23% per year. The enabling technology segment grew at a more modest 13%, followed by the internet access connectivity segment at 11% per annum, driven equally by increasing internet penetration in developing countries and the substitution of ‘non-internet’ services such as PSTN¹⁰-based voice and MPLS¹¹ (which are outside the internet value chain), with public internet services. The user interface segment grew at a slower 6% per year rate due to slowing device-refresh cycles and also growth in lower-value devices, reducing the average unit price.

Once users have a device and connectivity to the internet, it is almost inevitable that a large proportion of any additional spend will be on the online services, as they are able to do more online. The primary route to growth for internet access connectivity segment players is by connecting more people and more devices. The experience in most

markets is that once connected, although users may upgrade over time to higher speeds and consume more data, this rarely translates into sustained revenue uplift. Players in the user interface segment are similarly constrained, although they have some potential to sell additional devices to already connected users as well as devices with higher specifications and new designs. While the price of entry-level devices has fallen in many markets, making them more accessible, the price of top-end devices has also risen significantly, evidenced by the latest iPhone 13 Pro Max, which retails for around \$1,100. The online services segment, on the other hand, has two strong routes to growth. First, the increase in internet penetration represents new customers to add to and grow existing services. Second, there is considerable growth potential in continuing to bring previously offline services online and driving growth through virtualisation, e.g., Geforce Now, an online virtual gaming service, replacing physical consoles.

Figure 7.

Segment size comparison



Note: 2015 data restated where category definitions updated in 2020. 2008 totals scaled to align with revised 2015 total
 Source: Kearney

10 PSTN – Public Switched Telephone Network – the traditional dial-tone voice service
 11 MPLS – Multi-Protocol Label Switching – an advanced form of private IP network service used by Enterprises to connect corporate locations and data centres

As shown in Figure 7, this outperformance of online services versus other segments of the value chain has resulted in the online services segment representing 57% of the total internet value chain revenues, up from 48% in 2015, which itself had increased from 40% at the time of the first study in 2008. Given this is probably the most diverse of the five segments, covering a multitude of subsegments, this strong growth is to be expected. That said, it is important to keep in mind that this segment is very much reliant on the smooth operation and long-

term viability of the other segments that support it. We developed this framework in 2008 to understand how well the value chain is working in financial terms, and the questions we addressed then around its long-term health and viability remain just as relevant now. In the following sections we look more closely at specific trends affecting the overall value chain and the possible consequences as these dynamics play out.

Key Trends

1. The largest players are expanding services and ecosystem control

A key trend that was already emerging in 2015 and appears even clearer with the benefit of hindsight is the expansion of the portfolio of services being offered by each of the largest players in the value chain. Facebook had already bought Instagram and WhatsApp to expand its social media presence, and also Oculus VR headsets to gain a foothold in the nascent VR space. It has since launched Marketplace and payment services and has recently announced its intention to build its future business around metaverse services. Amazon was already well established in the cloud services subsegment with its AWS offer and had the Kindle e-reader devices range, but has since invested heavily in its Amazon Prime Video and Amazon Music streaming services, expanded its range of hardware to include FireTV and Alexa-based smart-home devices, and invested heavily in content rights. These examples illustrate a clear trend by some of the largest players to expand their role in the internet value chain in two ways: broadening the service offering and integrating services across the value chain.

1. Broadening the service offering

Companies have always looked to grow revenues, increase their customer base, and leverage supply-side scale and expertise to develop new products for new markets — be it organically or accelerated via acquisitions. Many of the large

internet players are following a similar path as they expand from their original core products (search for Google, social media for Facebook, e-retail for Amazon) into adjacent or even unrelated service areas. Further evidence of this trend can be seen in markets such as China and India, where there is increasing use of so-called super apps, which aim to combine multiple services into a single integrated app. The WeChat messaging service allows developers to add mini services to the platform, enabling users to complete tasks such as online shopping transactions and booking taxis. To facilitate the additional services, many of these super app platforms have financial transaction and digital wallet functionality built in, and some go a lot further, offering loans and credit. Alipay offers 120,000 such mini-programmes as add-ons to its core payment service. In India, Paytm offers a plethora of services beyond money transfer including mobile recharging and bill payment; train, flight and movie ticket booking; insurance; games; a platform to purchase stocks and mutual funds; and a complete e-commerce store. Companies such as Grab, Gojek and the SEA Group are doing something similar in Southeast Asian markets where many users are ‘mobile natives’.

2. Integrating services across the value chain

Several large players are also integrating across the value chain by combining different online services, enabling technologies and services, and end-user devices. By combining components, these players can innovate quickly and deploy at scale to a large existing base without the complexities of developing interfaces and integration with third parties. The result can be a more seamless customer experience for those happy to accept some of the limitations that a closed ecosystem model can bring.

Apple has been a leading proponent of this approach, leveraging the strong position of the iPhone in the premium user devices segment and a tightly controlled app store to direct customers to a tighter range of services and extracting a fee from subscriptions and purchases made by online service providers. Apple has grown its services division which includes iCloud, Apple Music streaming, Apple Fitness+, to the point where it was responsible for 22% of Apple's revenue in Q3 2021, bringing in \$17.5 billion in that quarter alone.

Unlike Apple, Google and Amazon have followed a more open, modular approach, offering each of the services as a standalone offer but also taking

the large scale of their online services to create so much workload that the other services benefit from the economies of scale. By having a large customer base for its Prime Video service, Amazon has the scale to justify buying a film studio, MGM, which brings a valuable back catalogue of content as well as the capability to create new, exclusive content that it can bundle, rent or sell via the Prime Video platform. Similarly, through its control of the Android operating system and Chrome browser, Google has the scale to develop information services such as Google maps and traffic services (which leverages live data captured from Android handsets), the suite of productivity software including Gmail, calendar, online meetings, productivity software (docs, sheets, slides), photo and back-up services, and many more. Developing any of these services in isolation would be prohibitively expensive and have no clear revenue plan to justify such an investment. However, if integrating into an overall ecosystem with hundreds of millions of users, the costs can be spread across a large user base and justified by relatively low revenue per user, or even just absorbed as part of the overall cost of ensuring the full portfolio of services are competitive and remain attractive.

Figure 8.

Example service portfolios of major players (illustrative)

Darker shading indicates the original or core service segment

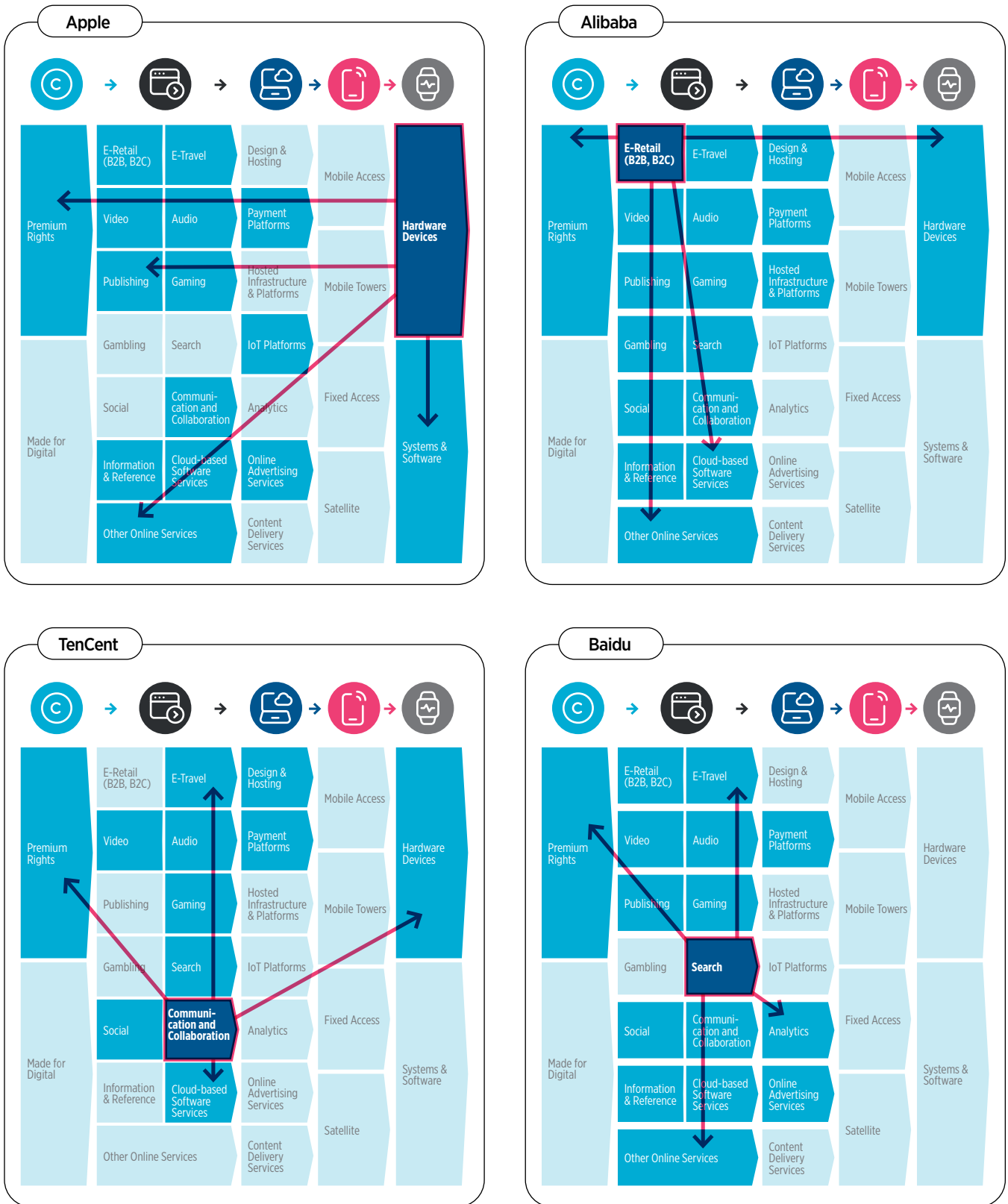
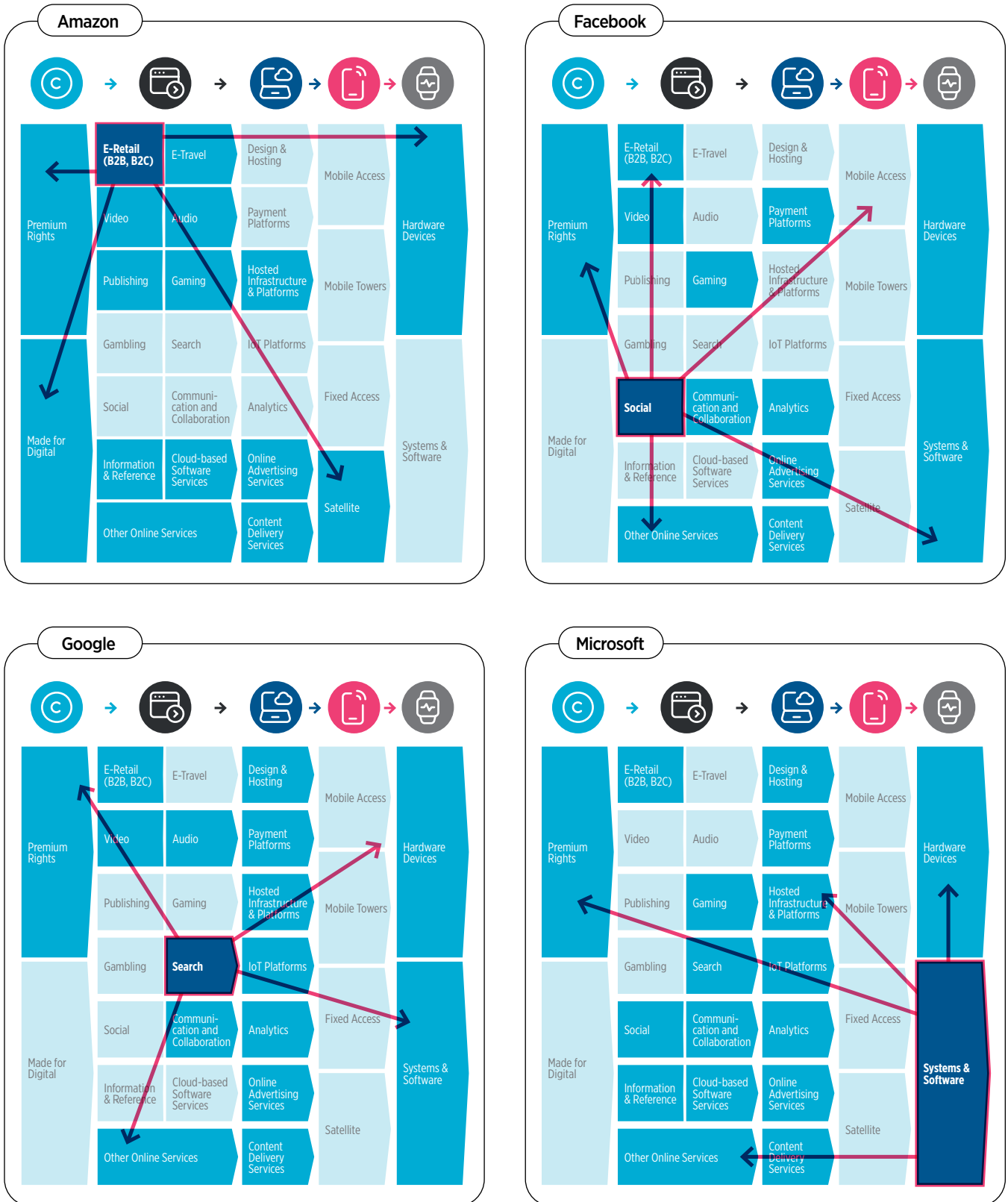




Figure 8 continued.

Example service portfolios of major players (illustrative)

Darker shading indicates the original or core service segment



Putting these two effects together, Figure 8 shows just how broad a footprint some of the large players have across the value chain. Although they may

Consequences

Some of these services, particularly cloud infrastructure services for example, have very strong scale effects and so it is in the interest of the providers to keep these as open as possible. Indeed, one of the biggest, AWS, was created by Amazon 'delaying' the infrastructure and technology they had built to support their retail operations and opening it up by making it available to other businesses as a service. However, in other service areas, a more closed approach restricting access to a given platform may make more commercial and technical sense. A closed ecosystem with multiple services working seamlessly together also makes it harder for users to switch to an alternative. For example, the lack of interoperability between various messaging systems means that users leaving the WhatsApp service (as many wanted to in 2021 due to a change in the terms and conditions of the service) would effectively force them to leave the WhatsApp groups and conversations they are part of.

be best known for one or two services, they have expanded selectively and now have a presence, often a very strong one, in many other categories.

There are already competition concerns that big digital platforms can use their control and knowledge of the customer to their own advantage. Developers and retailers selling via the Apple App Store and Amazon Marketplace have complained about being given only very limited visibility or access to the end-customers, restricting their ability to grow their own services. The development of metaverse services is likely to take this trend further with several parallel platforms emerging that integrate multiple segments of the value chain into closed ecosystems extending from the user device to online services and even content.

The concern about the market power of some platforms in certain segments is expanding to concerns about the power to control whole ecosystems, encompassing devices through to the online services and the various technology services that weave them together.

2. Advertising continues to grow, but paid subscriptions have grown the most in absolute terms

Advertising revenues have fuelled the rapid growth of many of the consumer online services, especially search, social media, online video and consumer publishing (e.g., news websites). As these revenues grow, there has been an open question around if, or when, they might plateau, given that there is only a certain amount of advertising an economy can support. Based on the data available for 2020, there is no sign of this growth slowing. Fifty-seven percent of advertising spend is currently online¹² and this share is growing at a steady rate as the offline

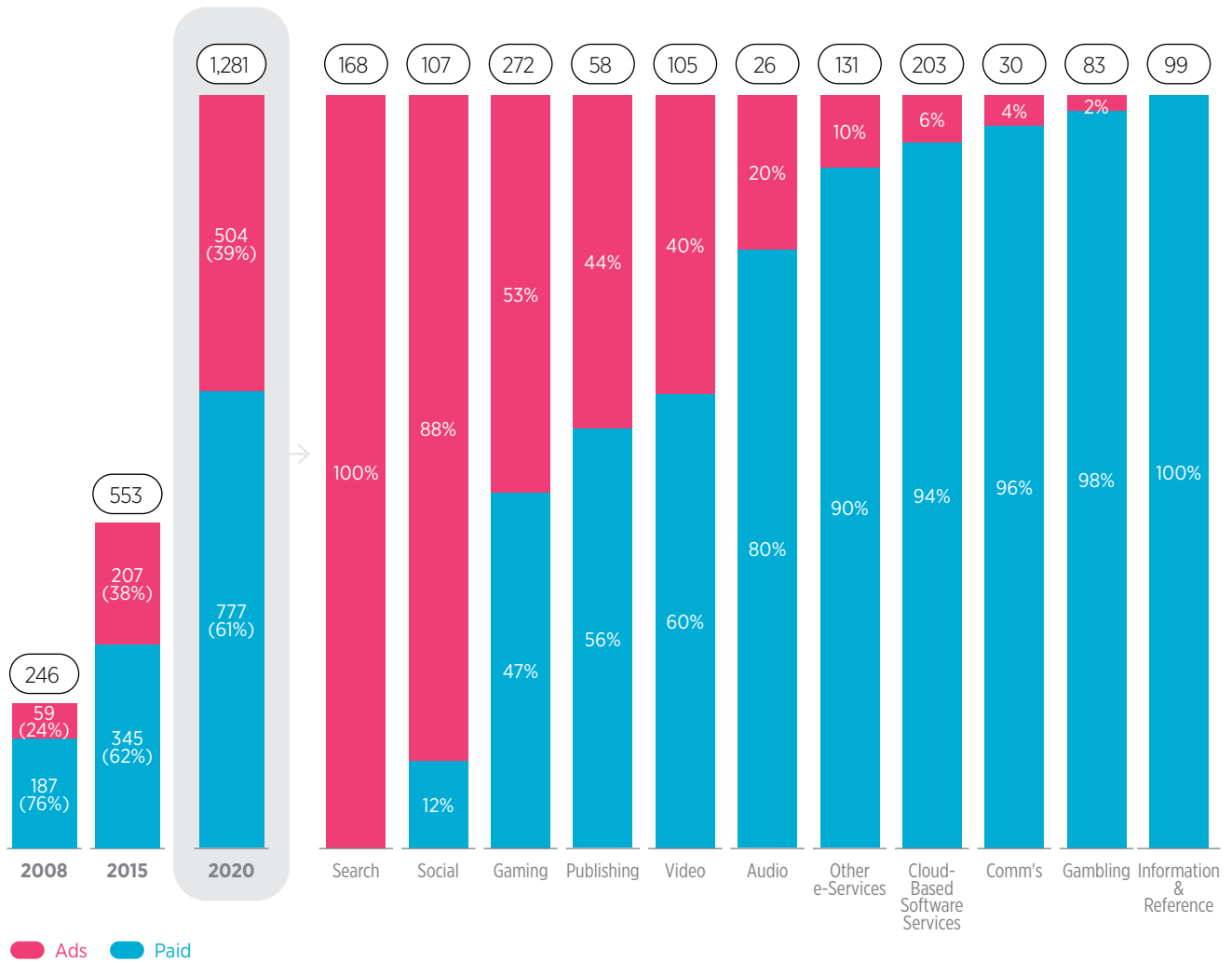
share of spend continues to migrate online. Figure 9 shows that of the total growth of the online services segment, excluding e-retail and e-travel (while they will also have advertising revenue streams of their own, are primarily sales transaction driven business) advertising revenues have grown from \$207 billion in 2015 to \$503 billion in 2020, an annual growth rate of 19%. Paid revenues (either subscription or direct purchases) for this segment of services have grown at a slightly slower rate of 18% p.a. over the same period.

¹² Word Advertising Spend, SNL Kagan

Figure 9.

Revenue sources for online services (excluding e-retail and e-travel)

\$ billion



Sources: PWC, Kagan, H2GC, Gartner, Omdia

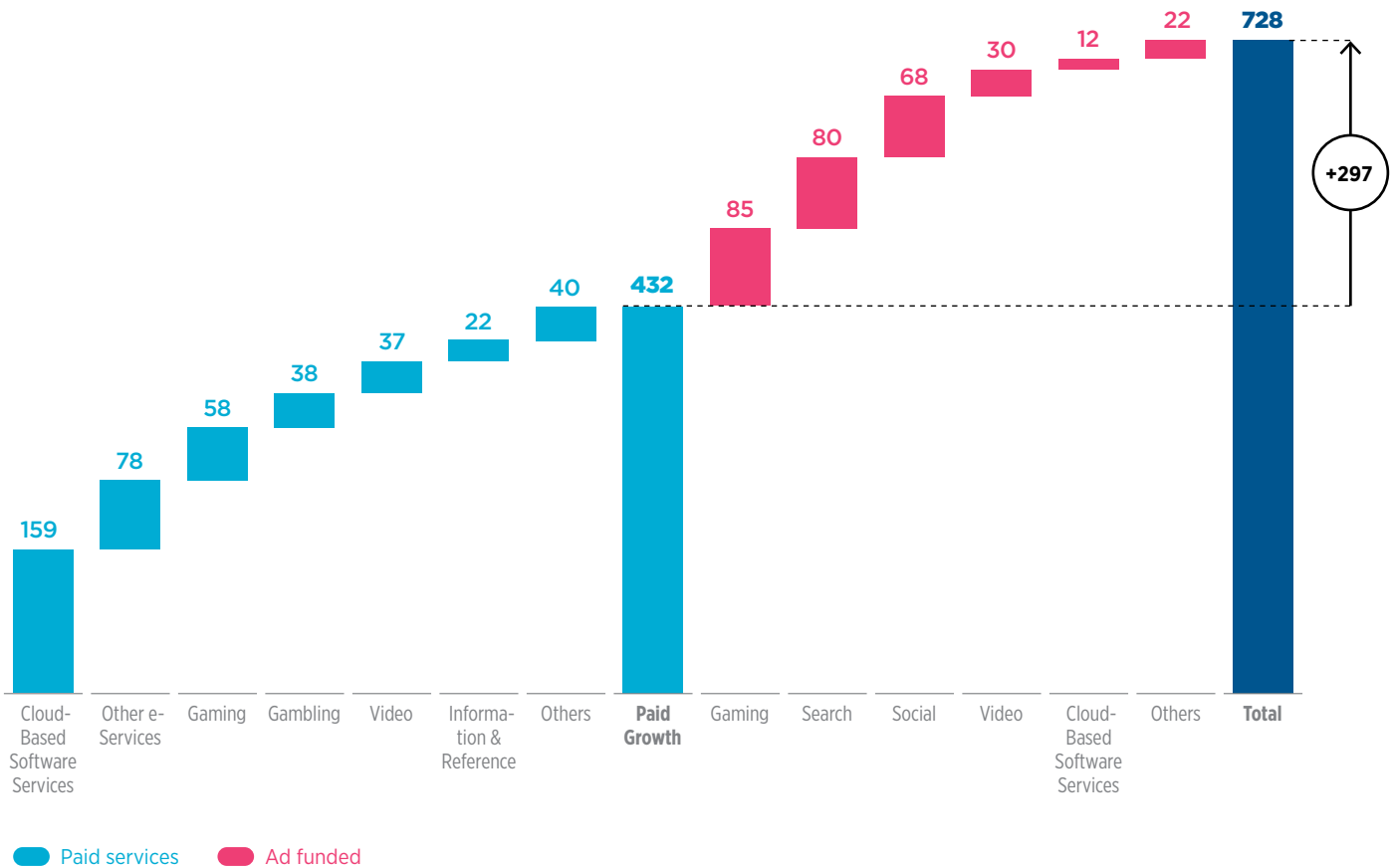
Despite their similar growth rates, it is clear that since the paid revenue streams make up 61% of the total revenue, they have contributed more in terms of absolute growth, delivering \$432 billion of additional revenue since 2015 versus an increase of \$297 billion in advertising-funded revenues.

Figure 10 shows that the categories driving this growth are cloud services, other e-services (including e-tutoring, health and the labour-based gig-economy type services, e.g., Byju's, Strava and TaskRabbit), gaming, gambling and video services.

Figure 10.

Growth in paid and advertising revenues, \$ billion, for online services

(excl. e-retail and e-travel)



The growth in advertising-funded services is still coming largely from gaming as well as search and social media services, which are growing strongly and are predominantly ad-funded. Advertising-funded video is also growing strongly due to platforms such as YouTube and other regional services. There is still potential for online advertising growth, and the transition from offline media to online will be helped by new tools that enable even better targeting of adverts. It is also true that those categories driving the growth are where the big platforms dominate, and they are also the ones best able to offer micro-targeted adverts due to the depth of data they hold on a very wide range of users. In the US market, Google (including YouTube) and Facebook (including Instagram) combined had 54% of the digital advertising market in 2020¹³, followed by Amazon with a further 10%, leaving only 36% of the market for other players.

In the paid-for segment, there is clearly still a lot of potential for activities that were previously offline to become online services. The effect of Covid and lockdowns resulted in an accelerated growth of streaming and gaming services as temporary replacements for cinema and other real-world experiences, but early data suggests that while the accelerated growth of the online services due to the pandemic has certainly slowed, e.g., Netflix and Peleton, much of this transition to online will not be reversed. The strong growth in cloud services is mostly coming from enterprises as they continue to digitise and migrate parts or even their full IT stack to public cloud-based services. Various sources show that this particular subsegment is still in the early stages and there is a lot more potential to use public cloud services.

¹³ eMarketeer, Oct 2021

There are also signs that the companies that based their business on a 'freemium' model are maturing their offers and their approach to increase monetisation. With a free entry-level service to attract customers, the challenge is how to persuade at least a subset of those choosing to pay to upgrade to access more advanced features. Cloud back-up services such as iCloud and Google Drive have begun charging for storage above certain (modest) limits. Because many users have taken the free service for granted as a means to backup devices and the fees are relatively low, the proportion of customers choosing to pay is likely to grow steadily. Other subscription-based online

Consequences

The continued growth of paid-for online services, which are likely to exceed \$1 trillion in the next few years, highlights the importance of the entire internet infrastructure. The value shown here of \$777 billion is the income to the online service providers, but there is also the large value of e-retail and e-travel transactions which take place in addition via some of these services.

It is also important to note that, while cloud-based software services, gaming, and video and audio services have been driving growth in subscription services in both the consumer and enterprise markets, it also comes with a shift from ownership of content and data to a 'pay to maintain access' situation. With subscription services, all access to the content ends if someone stops their subscription. For consumers, it is a trade-off between access to a very wide library of content for a finite period versus owning a small portion of content indefinitely. For businesses, the implications of ending a subscription are greater. Previously a company may have bought an accounting software package and then spent many years customising its set-up and populating it with data which then becomes a significant asset for the company (one they probably need to maintain and update periodically, as with any asset). However,

services are also developing a wider variety of subscription offers with different target markets and price points, e.g., Spotify Duo, Family and Student, and Netflix offering SD, HD and 4K services as a way to upsell customers and increase average spend per subscriber. Leading health app Strava has also been actively promoting paid subscriptions for what started as a free service. In most cases, it seems there is growing acceptance among consumers to pay for services where they see the additional value or they value the security of their data, such as health and wellness apps, perhaps accentuated by an increasing awareness that 'free' services are often paid for with personal data.

with cloud services, companies are locked in to paying the recurring fees until such time they find a way to migrate away to another service. Again, it is a trade-off between owning a fixed piece of software and paying for periodic updates or upgrades when needed, versus subscribing to an ever-evolving service and accepting the consequences this has for data ownership and transferability.

In the early days of online advertising the basic premise was advertisers 'paying for eyeballs', and so they could make several small payments to small sites to have same impact as going via large platform to reach a similar number of people. The development of the advertising ecosystem has led to the current situation where the value of eyeballs is based less on volume and more on how much is known about them. In this respect the large platforms, especially if able to follow users across multiple services, are able to gather a much richer dataset about users and also to provide access to largest target audience pools. Recent changes to Apple service to protect user privacy and proposed changes to Google's Chrome browser have had a substantial impact on Facebook's advertising revenues.

3. Digitalisation and the shift to online

Underpinning much of the growth of the internet value chain is the steady and unrelenting shift of activities that used to be carried out offline now being done online. For consumers, social media services and online shopping are well established and continue to grow, while entertainment in the form of online gaming and video and music streaming services have accelerated most recently. This has been enabled by increased internet access speeds, both via 4G and 5G mobile and also the steady upgrading of fixed networks to higher speeds, and also the wider affordability of smartphones that have the screens and functionality to enable financial applications, location-based services, etc. These advanced devices can then also connect to and leverage the data and processing power of the cloud-based services, enabling services such as real-time traffic routing, live transport information as well as advanced and interactive social media and gaming services.

In the enterprise sector, the digitalisation of processes and the new business models it enables has been a hot topic for years. However, with the arrival of more powerful connected devices, the connectivity of things, the resulting vast data availability and the availability of cloud, digitalisation takes a new twist. Enterprises are now able not only to outsource their IT, but to migrate and virtualise it in the cloud and to replace hard-to-maintain applications with software-as-a-service solutions. At the same they can equip their employees in the office or at home with connected devices, and also collect data from, and often also manipulate, probes and devices all over the world. The cloud gives them the computing power to make sense of the massive data they collect via advanced analytics — which in turn allows them to rethink their business and opens new possibilities.

Key to making this cloud-based model viable and attractive for enterprise customers is ensuring that, despite being remotely located, the applications and data are always accessible. Cloud-based infrastructure services do this by seamlessly transferring data between data centres so that computing loads can be switched easily and data backed up and replicated. Consequently, to ensure these services work as effectively as possible, the

cloud service providers have invested heavily directly in international and sub-sea telecoms capacity. The four largest companies, Microsoft, Google, Amazon and Facebook (which has built a major network of data centres for its own use, rather than direct commercial cloud service), now use 66% of available undersea-cable capacity¹⁴. Whereas most undersea cables are built by consortia of companies, previously telecom operators but now including the cloud players, Google has gone a step further and started building whole cable systems exclusively for its own use. However, when investing directly into the internet transport infrastructure, these companies are not subject to regulations and fiscal obligations that apply to telecom operators making the same investments.

The second key component is the ability for users to connect to the services wherever they are and whenever they wish. It depends on the nature of the application, but for many, these access connections need to be fast and reliable, whether it is for cloud-based data processing, real-time collaboration services or multi-user video calls. The more advanced use cases, particularly Internet of Things (IoT) services, rely on connecting a wide range of devices, then collecting and processing the data they generate. This data collection and processing, which could include constant streams such as CCTV or smart traffic systems, places a heavy load on the networks in terms of the number of connected devices and often the volume of data traffic, and in many cases will require edge computing to pre-process the collected data and/or to play back results with low latency. This places the most critical computing power physically closer to the end user to minimise latency, critical for real-time interactive services. Services such as cloud gaming, medical tech, connected cars and soon the metaverse will require very low latency and localised computing to deliver a smooth customer experience. In fact, applications like the metaverse, with its anticipated 3D interactive worlds, and future cloud-based gaming with advanced or immersive graphics are likely to need even more investment in edge networks to be able cope with high graphics intensity and highly interactive nature. This then makes the capacity and capability of the networks,

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from the core to the very edge, even more important to support future growth.

The connections at all points in the internet also need to have sufficient capacity at peak times to accommodate increases in demand for traffic. As shown earlier in Figure 2, traffic is growing at 34% year-on-year, and this has a direct impact on network operators, which must continually upgrade the capacity of their networks. Applications that impose heavy traffic demand on networks (e.g., video streaming or game and software updates) have no incentive to optimise the traffic they send,

Implications

These developments place a sustained demand on the networks, requiring continual investment in coverage, speeds and capacity, and also in additional computing functionality in the edge networks. Without this investment and the flexibility to manage traffic and optimise the networks, the

either by considering compression techniques or, in the case of software downloads, timing their traffic to off-peak times, placing additional strain on the capacity of connectivity providers. As an example of what could be done, during the initial onset of the pandemic, players like Netflix and YouTube temporarily downscaled the resolution of their video distribution in Europe to ease the load on networks, which Netflix estimated would reduce its traffic load by 25%¹⁵. However, under normal circumstances, video services look to upscale content as far as possible while delivering a smooth service.

internet access connectivity segment risks finding itself constrained in being able to support the growth and innovation across the value chain. The next section looks at the returns across the segments and the potential implications of unbalanced investment incentives and flows.

¹⁵ <https://www.politico.eu/article/netflix-moves-to-reduce-traffic-on-european-networks/>

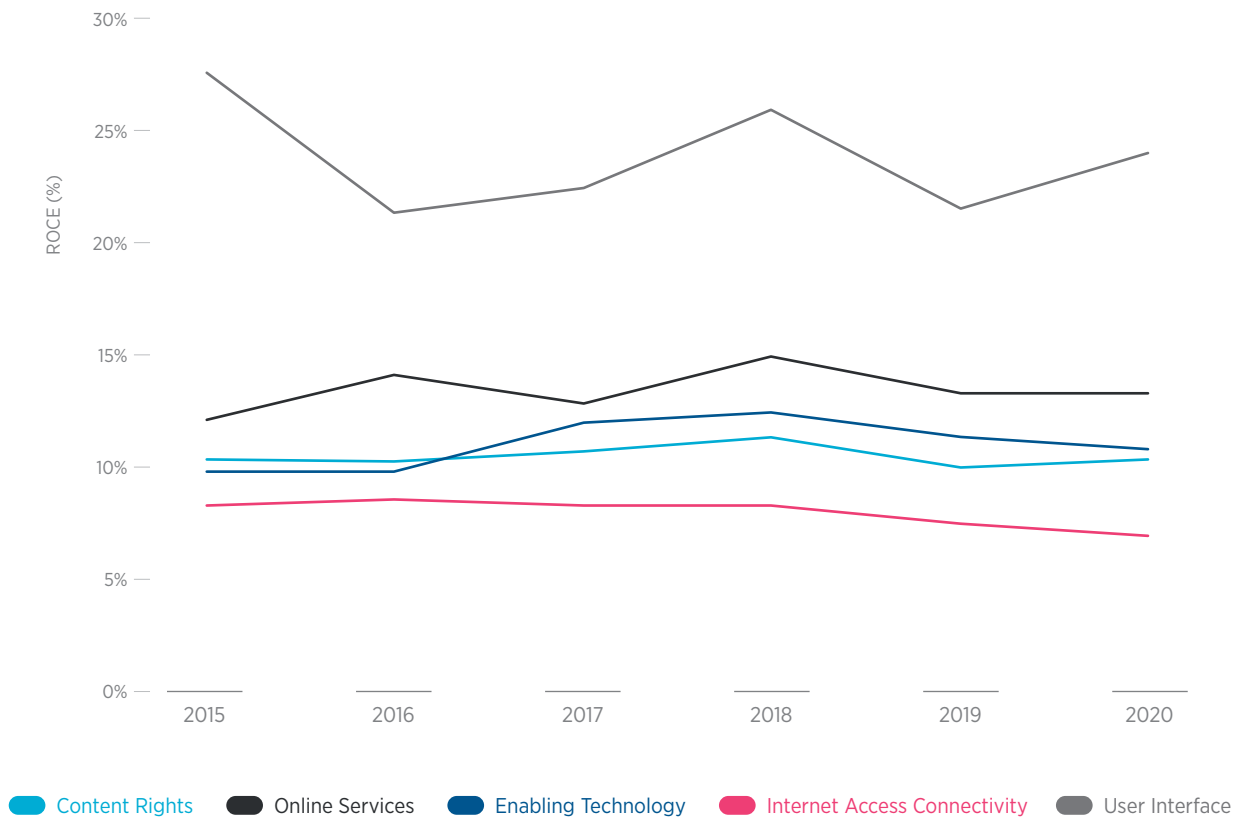
Value-Chain Returns and Implications

Financial returns are unequal along the value chain

As shown in the data above, the growth of digital services, whether streaming content, e-commerce or enterprise digitalisation, is powering the continued growth of the online services segment most strongly. A lot of innovation and investment is making this possible, particularly the increased functionality of end-user devices and sensors, advances in connectivity, growth of hyperscale technologies and cloud infrastructure through to application interfaces that connect these to the central systems of the service providers. Figure 11 shows the financial investment returns of the individual segments of the internet value chain since 2015, based on the revenue-weighted average of selected companies that operate predominantly in each of the segments. It should be noted that these ROCE¹⁶ figures and the following financials can only be indicative rather than exhaustive as they are based on published figures of the main players, but many have businesses spanning multiple segments and subsegments, while some also have offline services, and they do not disclose the financials of the different subsegments independently. We have therefore selected public companies that best represent each segment and subsegment to evaluate the typical economics and returns.

Figure 11.

Return on capital employed for the value chain segments



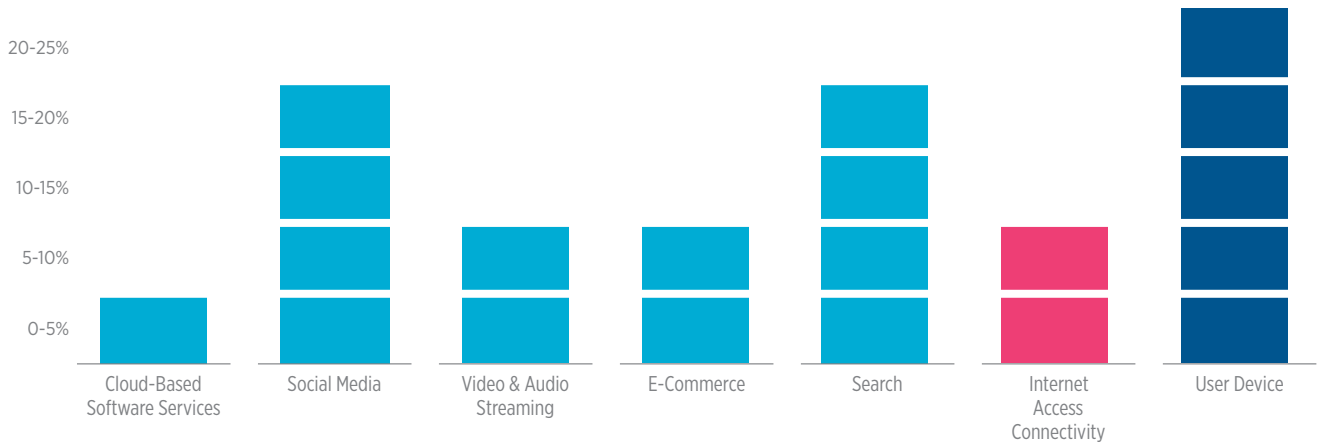
Source: Capital IQ, Kearney analysis

The telco operators making up the internet access connectivity segment already had low, sub-10% returns in 2015 and these have declined since then. The online service, enabling technology and content rights segments have been making reasonable

returns of between 10% and 15%, while the user interface segment shows much higher returns linked to their brand and intellectual property assets (which generate sales and returns but are not classified as capital employed in financial terms).

Figure 12.

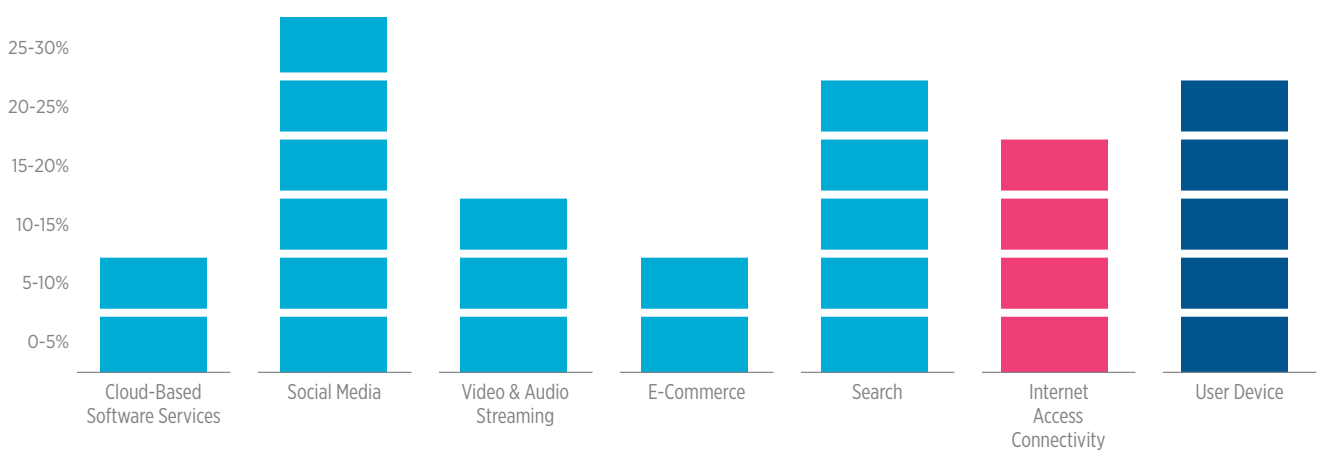
Return on capital for selected subsegments, 2020



ROCE % defined as EBIT over Total Assets less Current Liabilities
 Source: Capital IQ, Kearney

Figure 13.

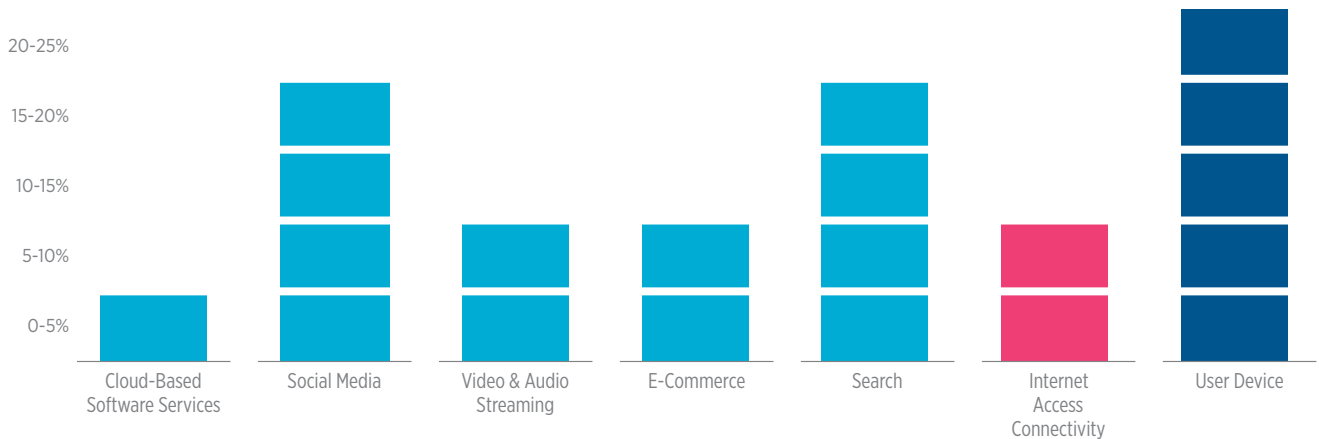
EBIT/revenue for selected subsegments, 2020



EBIT % defined as EBIT as % of Revenues
 Source: Capital IQ, Kearney

Figure 14.

Capex as proportion of revenue for selected subsegments, 2020



ROCE % defined as EBIT over Total Assets less Current Liabilities
 Source: Capital IQ, Kearney

Looking more closely at some of the key subsegments shows a much wider spread of performance. The segments have different economics and business models, so variations in the financial metrics are to be expected, but it is worthwhile to examine how they vary.

- **Returns on capital.** Figure 12 shows the typical returns for selected subsegments, again based on revenue-weighted averages of companies that best represent the subsegments. In addition to user interface (20%-25%), the social media and search subsegments stand out, with returns in the range of 15%-20%. E-commerce has more modest returns of 5%-10% due to the competitive, low-margin business models of large players like Amazon and Alibaba. The internet access connectivity segment had average returns of 5-10% in 2020. Although most of the companies in this segment are well established, it is also a capital-intensive segment with continuous investment in the infrastructure and assets needed, but also a fragmented (generally to national level) and highly competitive segment in most markets. Cloud-based software services has the lowest ROCE in 2020 due to this being a relatively new and fast-growing segment with many start-up type companies making low returns or still in loss-making positions.
- **EBIT¹⁷.** Figure 13 shows EBIT margins follow a similar pattern to ROCE. Social media, followed by search and user interface have high margins, being areas where global scale and network effects combine to drive strong revenues to the leading players, and having high barriers to entry. The more fragmented cloud-based software services subsegment has much lower margins. The internet access connectivity providers have more respectable margins, typical of established and stable businesses. It should be noted that the lower ROCE and EBIT returns of the other online service subsegments (cloud-based software services, streaming and e-commerce) are sustainable as long as they are able to continue growing, since many of the companies in those

subsegments are in an investment phase where they are spending to grow the business and expect higher future returns. The challenge for the internet access connectivity segment is that while the internet access revenues may be growing, overall their revenues are flat or declining (discussed further in the later section *The two-sided squeeze on the internet access connectivity segment players*).

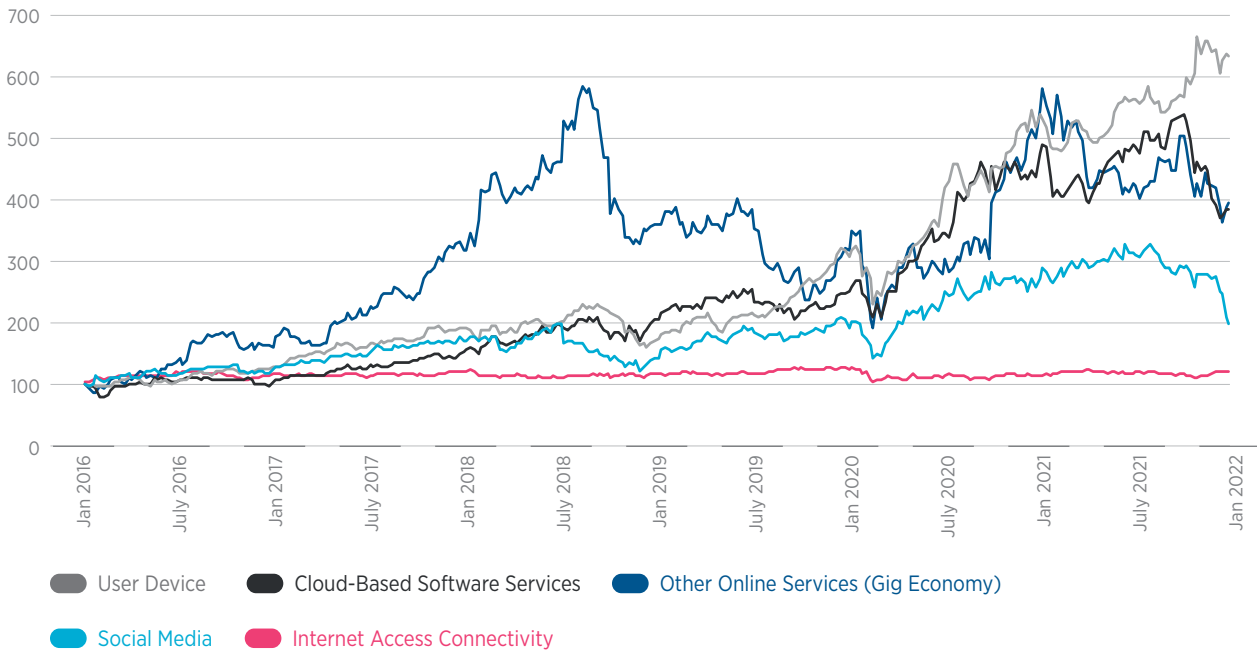
- **Capex-to-revenue.** Figure 14 shows the capex-to-revenue ratios of companies in each of the subsegments. Clearly, different segments have different capital intensities and will spend a greater or lesser proportion of their income on capital projects. Social media and search categories are investing a relatively high proportion of revenue on capex in order to scale up and support their ongoing growth (and future revenues), as well as investing in new technologies such as the metaverse which are yet to generate revenues. Players in the user interface segment typically invest more into R&D and design, but outsource the more capex-intensive manufacturing activities to contract manufacturers. The telecom operators on the other hand are typically spending 10-15% of revenues rolling out fibre and 5G services, although some converged European operators are spending at or even over 20% of revenues currently.

The best way to consider the net impact of the current and future financial performance and returns is to look at total shareholder returns, which takes into account share price movement and cumulative dividend payments over the period. Figure 15 shows the relative shareholder returns of representative public companies operating in the selected sub-categories, indexed to 100 in January 2016. These are based on blended averages; obviously there is a spread of performance across the individual companies.

17 EBIT – Earnings before interest and tax (but after accounting for depreciation and amortised costs)

Figure 15.

Relative total shareholder returns of selected segments, indexed to Jan 2016



Source: Capital IQ, Kearney

User device companies such as Apple, Sony and Samsung have delivered consistently over the period resulting in over six times value growth for their investors on average since 2016. Cloud-based software services and other online services, including gig-economy services, have had a volatile ride from 2016, but really accelerated from January 2020 as the world adjusted to the Covid pandemic. Share prices have dropped back in recent months but both categories have still delivered four times growth for their investors. Social media companies

have shown more modest but steady growth over the period, although concerns about their ability to continue to collect user data to drive their advertising revenues (due primarily to changes in Apple privacy controls) as well as increased competition in the sector have impacted their share price from mid-2021 onwards. The average performance of the internet access connectivity segment has delivered the lowest returns over the period, although it has also been the least volatile.

Implications

The relative performance of these sectors has important implications, since the expected shareholder returns ultimately determine the flow of future investments. What is perhaps lost in the financial figures is the interdependence of the segments. The lion's share of the value of the digitalisation is being captured by the services that most palpably touch the end consumer, not by the connectivity that enables it.

The large online players are already using the income from today's services to make large investments in developing what they plan to be the future services,

most prominently the metaverse services, together with the virtual reality and advanced hosting technologies needed to facilitate this. The medium to long-term incentive of telecom operators to keep investing capex at rates of up to 20% of revenue given the sub-10% returns on capital is a particular concern, and the performance of their share prices illustrates this starkly. There needs to be a balanced approach to the ability to earn fair returns on investment across the internet value chain if it is going to continue to grow. If there is a shortfall in a particular segment it risks undermining the potential of services in dependent segments.

The two-sided squeeze on the internet access connectivity segment players

Telecom operators, the main providers of internet access services, initially did well out of the adoption of the internet, adding a new consumer service on top of the existing voice and SMS services. However, as new internet-based services have replaced these, the growth they provided has been more than offset by the decline in the previous revenue streams. Two trends are now putting the internet access connectivity providers into a squeeze. On one side, the decline of revenues in the enterprise segment is now accompanying similar developments on the consumer side, with the growth in broadband access

coming at the expense of a commensurate decline in offline service revenues. The move to cloud-based services is reducing the need for secure, private enterprise data networks, and therefore reducing sales of VPNs, MPLS networks etc. and replacing these with lower margin internet-access connections. On the other side, operators who want to improve their ROCE and reduce costs are separating out assets such as the tower estate so that they can optimise their value.

1. Transition from private network to public internet access services

As enterprises transition to public cloud-based services, the connectivity services they are buying from operators is shifting from private networks (Ethernet VPN and MPLS services) used to connect corporate office locations and private data centre facilities, to public infrastructure services where the main service sold is internet access. When requiring a private-network function, enterprises start using software-defined networks that replicate the security and routing characteristics familiar in private networks using the public internet infrastructure. From a telecom operator perspective,

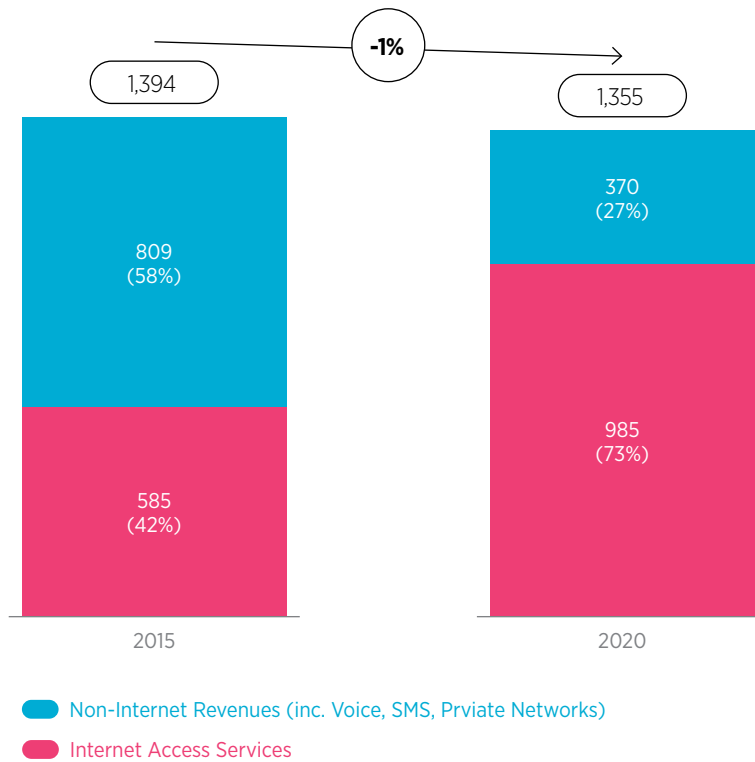
they are selling the access portion (the physical fibre connection into an enterprise office is the same for both) but without the core network services they would previously have sold on top, reducing their returns while requiring the same asset base to deliver.

Figure 16 shows the total telecom operator revenues split into internet access services (captured within the internet access connectivity segment of the value chain) and the non-internet service revenues.

Figure 16.

Evolution of telco revenues (fixed and mobile, consumer and enterprise)

\$ billion



Source: Gartner, Kearney analysis

While the internet access service revenues have increased significantly from \$585 billion in 2015 to \$985 billion in 2020, this growth has been more than offset by the decline in non-internet-related services, primarily private data networks and declining voice revenues, which have historically been higher-margin services relative to the more commoditised internet access services. As a result, total telecom operator revenues for fixed and mobile services combined have declined slowly over the period, at a rate of 1% per annum.

This revenue and margin loss is being compounded by the large cloud companies directly buying and investing in international capacity to connect data centres, circumventing what has traditionally

been a telecom operator service. In some markets, regulators have reserved spectrum bands for private enterprise 5G networks to enable campus networks and specific 5G applications to be developed, such as highly automated, connected factories. This creates an opportunity for the network equipment vendors, especially those with fully virtualised products, and the hyperscale platforms to now compete for this business and bring their global scale to local implementations. Amazon Web Services has launched a managed service called AWS Private 5G to help enterprises set up and run private 5G networks on their facilities — basically extending the software-defined network model towards the local access network.

2. Drive for efficiency is reducing the field of play for operators

A natural response in many industries to declining revenues and margins would be consolidation, particularly in capital-intensive industries, to take advantage of scale efficiencies and improve the utilisation of the asset base. Telecom operators have pursued scale and efficiency gains where they can. In mobile, this has been through various forms of network sharing, whether of passive assets or active, as a means to reduce the costs of operating the access networks. Many operators have also sold portions of their tower estate, effectively using a third party to achieve the scale efficiencies, and in some markets operators are looking at shared ownership of their radio access network (RAN) to form a wholesale operation with potential to share investment costs and improve utilisation.

A separate initiative to increase efficiency has been the virtualisation of core network functions, enabling them to run in remote data centres and removing

the need for more capital-intensive equipment and freeing up exchange and central office real estate. Some operators have even taken the opportunity of this decoupling from the physical network to host the virtual applications in public cloud services.

This has created an opportunity for infrastructure investors to move into the passive asset space, buying up and consolidating tower companies, while the large cloud players have made moves into the virtual infrastructure space. In 2021, Microsoft bought Metaswitch and Affirmed Networks, two leading vendors of core network software, whose products it can now host on its cloud platform and offer 'as a service' to telecom operators around the world. If the cloud players start to take a larger role and orchestrate this layer more, then the field of play for the operators within the internet access connectivity portion of the value chain will ultimately be reduced, and consequently their revenues and margins.

Implications

The net result of these two trends is that just when operators are expected to invest in expanding and upgrading the access networks, the revenues and margins they earn from these networks are declining. This has a detrimental impact on their ROCE on both sides — more capital investment is needed to upgrade the networks, but the returns are lower as revenues for core services decline.

Operators are meeting this challenge in part by carving out the infrastructure assets and sharing

them to increase asset utilisation. They are also tapping into infrastructure investment funds to meet capex needs, but in financial terms this replaces the upfront capex need with a long-term opex cost which still pressures the operators' margins and returns. The clear consequence of such an outcome is that with lower revenues and margins, the potential to invest in the critical access infrastructure could also be reduced in the long term.

Conclusions

Overall, the internet value chain continues to grow at a steady 15% per year and shows no sign of slowing down. There is no shortage of developments, innovation and expansion into new areas of technology that will enable and also drive the continued shift of activities that used to be offline into an online format, whether that is in the form of cloud-based business services and processes for enterprises or by the acceleration of consumer behavioural shift towards online, which results in an increased share of time and money spent online. As innovation moves into entirely new segments and platforms, most notably metaverse-type developments, future developments may be less about the next big service, and rather about the emergence of entirely new, parallel ecosystems.

In the enterprise space, as ever more business-critical assets and activities are migrated to public-cloud-based infrastructure, the fabric of the internet becomes increasingly integral to the daily operation of enterprises and economies, as the almost instant transition to remote working during the pandemic highlighted.

However, as these new revenue opportunities open up across the value chain, the telecom operators building and running the underlying and enabling infrastructure are not necessarily benefitting as much as one might expect. Despite the growth across the overall value chain since 2015, the ROCEs of the telecom operators, which were already below 10%, have declined further. The returns to their shareholders have been equally low, raising questions about the ongoing robustness of investment in capacity, coverage and speed of the networks that connect internet users with services.

Business leaders and policymakers need to fully appreciate the critical role of the internet infrastructure and work to ensure that market distortions, regulatory requirements or other factors are not limiting the ability of participants to make sufficient returns in all segments of the ecosystem and that all segments can make a fair return. This would sustain long-term investment, and not just those businesses that have the biggest platforms and scale. The telecom operators have an important role to play and need the right incentives to keep investing in networks, both in core network capacity and increasingly in edge functionality. It is in the interest of the entire ecosystem that robust investment continues in the networks required to realise the full technological potential of future internet innovations.

Methodology

Internet Value Chain Definitions by Segment

Below are further details on the approach taken for the categories and subcategories included in the internet value chain, with a focus on the revenue sizing approach, to complement the descriptions provided in the main report.



Content Rights

Subsegments		Description & Methodology
Premium Rights	n/a	<p>Market size is based on the percentage of revenues from online services that is paid to content rights owners, either as:</p> <ul style="list-style-type: none"> • Revenues from digital product sales after commission • Content acquisition or licence cost • We estimate the percentage of total online revenues that flows to the corresponding content rights owners. <p>The value included is incremental. That is, it reflects the additional value generated from content in the internet economy.</p>
Made for Digital	Content Creators and Influencers	Revenue generated via video and audio platforms by independent content creators and influencers. This includes sponsoring revenue, share of video advertising revenue as well as podcast advertising revenue.



Online Services

Subsegments		Description & Methodology
E-Retail	B2C Retail	<p>Products or services ordered using the internet via any device, regardless of payment or fulfilment method; excludes travel and event tickets. Includes revenues from 'click-and-collect' sales transactions.</p> <p>Revenues are based on total transaction values less the direct cost of the goods or services sold and fulfilment. The percentage to be subtracted is an estimate based on company reports for leading operators.</p> <p>Excludes video, music, gaming, e-books, travel, cloud, labour services which have their own categories (see below).</p>
	B2B Retail	<p>Sales transactions between businesses (including manufacturers, wholesalers, and retailers) conducted through the internet, including via mobile e-commerce.</p> <p>Revenues are based on total transaction values less the direct cost of the goods or services sold and fulfilment. The percentage to be subtracted is an estimate based on company reports for leading operators.</p> <p>Excludes EDI transactions, professional publishing, directory, B2B information services, B2B communications, business e-learning, and business cloud services, which have their own categories (see below).</p>
E-Travel	n/a	<p>Covers all leisure travel spending as well as unmanaged business spend. Within scope is spend on air tickets, hotel stays, rail tickets, and car hire and out of scope commuter travel, travel by boat and coach, incidentals, food or consumables, and other travel spend like priority boarding and baggage.</p> <p>Online asset sharing and transport-based services are also included (Uber, Airbnb etc...)</p> <p>Revenues are based on total transaction values less the direct cost of the service sold.</p>



Online Services

Subsegments		Description & Methodology
Video	SVOD (OTT)	<p>Subscription video services provided through OTT channels, bypassing traditional broadcast TV. Includes players such as Netflix and Hulu.</p> <p>Includes both on-demand and live streaming services.</p> <p>Includes stand-alone online services from pay TV operators (for example, Sky's Now TV); excludes pay TV operators' multiscreen packages (such as Sky's Go or Comcast's Xfinity).</p> <p>Excludes any revenue generated by pirate services.</p>
	SVOD (Multi-screen)	<p>Digital home video through online video-on-demand and pay-per-view services provided by a pay TV operator as part of a subscription package</p> <p>Includes proportional revenue from operator 'TV Everywhere' packages (such as Sky's Go or Comcast's Xfinity) that bundle OTT with conventional pay TV services; excludes revenues from stand-alone OTT services (for instance, Sky's Now TV).</p>
	Open VOD	<p>Ad revenues from instream video advertising (including pre-roll, mid-roll, end-roll, and related formats) shown within a video stream or livestream. Excludes any revenues from banner overlay ads or from direct sponsorship of video content.</p> <p>Excludes instream revenue from social networks (i.e. Facebook Video)</p>
	Digital rentals or purchases	<p>Purchases or downloads of digital filmed entertainment products. Includes websites providing online rental transactions of physical filmed entertainment products (although this share is considered negligible).</p> <p>Includes only the revenue share/gross margin of the online service provider.</p> <p>Excludes any revenue generated by pirate services.</p>
Audio	Streaming	<p>Revenues from subscription or advertiser-supported streaming audio content-on-demand services (for example, Spotify or Apple Music).</p> <p>Includes online only radios.</p> <p>Excludes any revenue generated by pirate services.</p>
	Music Sales	<p>Revenues from licensed recorded music downloads via app stores or other licensed services (such as iTunes, Google Play).</p> <p>Includes only the revenue share/gross margin of the online service provider.</p> <p>Excludes any revenue generated by pirate services.</p>
	Podcasts & Internet Radio	<p>All revenue from adverts carried within podcasts. Excludes revenue not directly within the podcast (e.g., banner ads on a web page).</p> <p>Share of terrestrial radio advertising revenue originating online.</p>



Online Services

Subsegments		Description & Methodology
Publishing	Consumer Publishing	Digital advertising, subscription, and pay-per-view revenues for consumer magazines and newspapers. Includes pure-play digital players such as BuzzFeed or Huffington Post.
	Professional Publishing	Revenues from digital advertising and circulation of global trade magazines and business newspapers.
	Digital book sales	Net revenue from the sale of electronic books (both consumer and business). Includes digital audiobooks services, either subscription or single copy.
Gaming	Video Gaming	Includes digital console games, online or microtransaction console games, digital PC games, and global online or microtransaction PC games. Revenues include subscriptions, and the sale of in-game virtual items. eSport revenues (ticketing and sponsoring) are also included in this subsegment
	Casual	Includes app- and browser-based social or casual gaming revenue.
Gambling	n/a	Websites and applications providing all types of online gambling services, including betting, casino, lottery and other gaming services.
Social & Community	Social Networks	Advertising revenues generated on social networks such as Facebook, Twitter, LinkedIn and Chinese Weibos.
	Online Dating	Online and mobile dating revenue (mostly subscription with some advertising revenue).
Communications & Collaboration	IP communications	Includes OTT VoIP and consumer IM. OTT VOIP only includes third-party VoIP. That is, it includes VoIP based on bespoke applications downloaded by end users from a website. VoIP operated by telecom operators is excluded.
	B2B Communications	Comprises of revenue of UCaaS which replace premise-based PBX and provide value added application and unified communications (UC) (aggregates telephony, presence/IM, messaging, collaboration, and conferencing).
Search	n/a	Advertising revenues generated by search engines through paid-for results (for example, Google AdWords).



Online Services

Subsegments		Description & Methodology
Information & Reference	B2B Information Services	Digital share of revenues from business-focused data and intelligence services.
Cloud-based Software Services	SaaS	SaaS is an application or software provided and managed remotely by one or more external suppliers. SaaS applications in scope includes business intelligence applications, CRM, digital content creation, enterprise content management, enterprise resource planning, office automation suites, other applications software, project and portfolio management, supply chain management, web conferencing, teaming platforms, and social software suites. Includes enterprise and consumer related revenue (subscription and advertising).
	BPaaS	BPaaS (Business Process as a Service) is the delivery of business process services (BPSs) via the cloud. Mostly automated they don't require much staff support. Typical services available: Customer Management; E-Commerce Enablement; Finance & Accounting; Human Resources; Supply Management; Cloud Payments Processing; Product Industries; Service Industries.
Other Online Services	Health & Wellness	Subscription revenue derived from health & wellness focused apps/sites/hardware (premium subscriptions to Strava or smart watches for instance).
	Smart Home	Subscription revenue from smart home equipment services.
	Labour services	Revenue from online platforms connecting freelancers to consumers or enterprises (such as taskrabbit). Revenues are based on total transaction values less the direct cost of the service sold. Revenue is for 2019 as impact of lockdowns across the world made 2020 non representative.
	Online learning	Revenues derived from online-only and online delivered degrees and courses or learning modules.
	Other	Online user revenues from paid-for apps, in-app purchases, and any other internet-based user-paid services. Also includes other web-based or in-app advertising.



Enabling Technology and Services

Subsegments		Description & Methodology
Design & Hosting	n/a	<p>Companies that design and develop both websites and apps</p> <p>Companies that provide a service allowing individuals or organisations to store their websites on their servers and make them available on the internet.</p>
	Payment Gateways	Companies providing systems that process end-user online payment transactions.
Payment Platforms	Digital Wallets	<p>Mobile or online-based service which stores a customer payment details and allows consumers to purchase services. (ie. PayPal).</p> <p>Revenues are based share of b2c e-commerce transactions in 2020 where digital wallets were used multiplied by an average transaction fee for this type of service.</p>
	SIM management and IoT platform	<p>Revenues from connectivity management platforms which are a collection services and software solutions supporting various functions which allow to manage cellular IoT device SIMs over public mobile networks (such as provisioning, billing, security, troubleshooting etc...)</p> <p>Connectivity revenues are included in mobile access.</p>
IoT	IoT applications and solutions	Software and services that allow IoT developers to build industry and application specific features and functionalities .
Advertising	Online ad networks or exchanges	<p>Online ad networks' or exchanges' share of net global advertising revenues.</p> <p>Includes companies that:</p> <p>Provide intermediary online advertising services to advertisers.</p> <p>Acquire ad inventory from websites to resell to advertisers or to programmatic or other platforms for buying and selling inventory.</p> <p>Offer tools to optimise online advertising effectiveness.</p>
	Online Ad Services	<p>Online ad servers' share of net global advertising revenues.</p> <p>Online ad server companies offering technology that places ads on websites.</p>
	Online Ad agencies	<p>Online advertising agencies' share of net global advertising revenues (that is, net of discounts, regardless of rate card).</p> <p>Online advertising agencies include companies that:</p> <p>Offer data and analytics on internet user and usage metrics.</p> <p>Provide services to plan online campaigns and acquire online ad inventory for advertisers.</p> <p>Design, produce, host, and serve online ads.</p>



Enabling Technology and Services

Subsegments		Description & Methodology
Internet Analytics		<p>Companies offering data and analytics on internet user and usage metrics.</p> <p>Includes licensing providers only, as cloud-based providers are captured under the SaaS subsegment of cloud services.</p>
Managed Bandwidth & Content Delivery	Core network and interchange	<p>Includes companies that own and operate the core telecommunications network, providing wholesale services to retail access providers, and operators providing the 'super-exchanges' of internet traffic between core network operators.</p> <p>There are limited stand-alone or independent interchange operators besides Level 3 Communications and XO Communications, which are both US operators. In most other major markets, large telecom operators provide interchange services.</p> <p>Global wholesale revenues are used in the sizing calculations.</p>
	Content delivery optimisation	<p>Companies that offer services to optimise the flow of content through the internet.</p> <p>Includes media delivery, website and network performance, security, analytics, edge/serverless, and servicing and support.</p>



Internet Access Connectivity

Subsegments		Description & Methodology
Mobile Access	n/a	<p>Includes spend on internet access over cellular air interfaces, generally via 3G, 4G or 5G network.</p> <p>Sizing is based on a number of data sources since many subscribers buy a bundle of voice, data, and SMS without specific tariffs attributed to each.</p> <p>Handset payments are excluded and captured in the user interface segment.</p> <p>Excludes revenue attributed to mobile tower companies.</p> <p>Analysis includes both consumer and business services, as well as services from network operators and MVNOs.</p>
Mobile Towers	n/a	<p>Service revenues from mobile tower companies. Excludes ancillary services and non-telecom related revenues.</p> <p>Revenue is estimated based on the top 25 tower companies' revenues and share of total number of investible towers and sites worldwide.</p>



Internet Access Connectivity

Subsegments		Description & Methodology
Fixed Access	Connectivity	<p>Connectivity spending over fixed networks, delivered to end users over access technologies such as DSL¹⁸, cable DOCSIS, and direct fibre.</p> <p>Includes services by fixed infrastructure owners and operators using unbundled local loops.</p> <p>Excludes private data network services often used by business customers as part of corporate networks.</p> <p>Analysis includes both consumer and business services.</p>
	VPN services	Revenues from services/apps providing VPN connectivity across the public internet.
Satellite	n/a	Satellite provided broadband: End-user broadband services; middle-mile connectivity for internet Service Providers; and mobile broadband services.



Enabling Technology and Services

Subsegments		Description & Methodology
Hardware Devices	Smartphones	Revenues from the sale of smartphones (defined as handsets that are powerful enough to offer multitasking capabilities, always on connectivity and have an app ecosystem).
	Tablets	<p>Includes both basic and utility tablets designed primarily to be consumption devices.</p> <p>Examples of devices included in this subsegment are iPad, iPad Mini, Android-based tablets, and white-box vendor products.</p>
	Smart TVs	<p>Smart TVs are TVs having the built-in functionalities to connect to the internet and offer applications leveraging it. In scope are TVs that are actively connected to the internet.</p> <p>An actively connected smart TV is one that: 1) actively accesses online services or locally shared content from other devices in the home, without the use of an additional device or accessory, and 2) is used in this way at least once per year.</p>

¹⁸ DOCSIS: data over cable service interface specification; DSL: digital subscriber line; IP: Internet protocol; IPsec: Internet protocol security; MPLS: multiprotocol label switching; VPLS: virtual private local area network service; VPN: virtual private network



Enabling Technology and Services

Subsegments		Description & Methodology
Hardware Devices	Digital Media Receivers	Market value of digital media receivers, such as Apple TV, Roku, Chromecast, and Amazon Fire Stick.
	Set-top boxes	Based on the market value of IP-connected set-top boxes. Estimates based on IPTV STBs sale value.
	PCs	Based on total worldwide PC sales, with a proportion based on the percentage of PC time spent on the internet. Includes laptops, netbooks, and ultrabooks.
	Game Consoles	Personal gaming devices with the ability to connect to the internet. Based on total worldwide console sales, with a proportional allocation based on estimates of share of consoles that are regularly connected.
	Smart Devices	Smart devices using internet connectivity to provide enhanced services. Includes smart home, smart appliances, smart security, smart utilities and smart assistant type devices. Connected vehicles are included in this subsegment using a notional value for the cost of the connectivity elements, rather than the vehicle value, since internet access is not its primary function.
	Wearables	Retail revenues of wearable electronics. Designed to be worn by the user, these include watches, clothing, and smart glasses, (incorporating computing or sensory capabilities). Devices obtained via third parties such as employers or medical institutions are not included. 100 per cent of the value is attributed to the internet, as functionality and benefits are wholly dependent on having connectivity—regardless of the source of that connection. (Not all wearables have inbuilt internet connectivity; many currently require a secondary device to provide a connection.)
Systems & Software	Operating Systems	Estimates based on Microsoft Windows revenues (both volume OEM licensing and retail OS revenues.)
	App Store	Based on the percentage of revenues from app store purchases by app store operators.
	Software	Based on the global revenue for public internet focused information security software (includes threat management, endpoint security, network security, messaging security, and web security.) Also includes other internet-related software, including browsers. Excludes VPNs which are included under connectivity.

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