Australian Government

acma

Australian Communications and Media Authority

Market analysis

Communications supply chain market study

Services, applications and retail

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Contents

Executive summary

This market study considers key trends across the communications supply chain, with a focus on the services, applications and retail market. Analysis is based on an assessment of demand and supply-side implications of downstream markets.

This study highlights considerable changes in the Australian retail communications market. Consumers expect greater connectivity, bandwidth, speeds and connected devices. Enterprise and government customers seek communication services for greater operational efficiency and to provide support services such as cyber security.

From a consumer perspective:

> Consumers continue to shift to internet-based services, including for traditional voice and messaging, gaming and mobile payment services.

From a service perspective:

> Telcos (telecommunications providers) are responding by expanding their service offerings and forming partnerships with industry. Investments are being made to support higher-capacity networks and to offer cloud-based services.

From a supply chain perspective:

> These trends are resulting in 5G network infrastructure and equipment upgrades.

> Growing demand for consumer devices continues to create pressure on chipset manufacturers.

> Cloud and edge computing are driving data-centre expansion and growth, with this expansion capability typically delivered by hyperscalers (global cloud service providers with massive-scale cloud infrastructure) such as Microsoft and Amazon Web Services.

Terrestrial broadcast and pay-television services have been excluded from this study. Private networks will be considered as part of a standalone market study to be published in 2023.

This report forms the second part of the *Communications supply chain market study: From equipment and spectrum to wholesale services*.

Key trends

The key market trends and the impact on the Australian communications supply chain impact are presented in Table 1.

Table 1: Key market trends and the impact on the supply chain

Market trend	Supply chain impact
There is greater consumer and business reliance on connectivity for a greater variety of services and apps. This is pushing demand for more tailored data plans and connected devices.	Australian telcos are diversifying their product offerings to meet growing retail demands: > greater mobile and fixed data allowances > tailored plans for services (such as gaming optimiser plans) > partnerships with content suppliers (Optus Sport acquires exclusive sport content) > new offerings (such as direct-to-mobile technology) > deploying massive-scale internet of things (IoT) platforms. Telcos are investing in network upgrades to support growing traffic volumes. This includes radiocommunications infrastructure (backhaul, subsea cables, satellites, towers or cells, sites, fibre links) and equipment (base stations, routers, antennas). The demand for consumer devices (smartphones, wi-fi modems, gaming consoles, IoT sensors) is increasing pressure and reliance on equipment manufacturers.
Enterprise and government customers are seeking ways to cut costs, scale their business and improve operational efficiencies. This is leading to greater demand for industrial automation, monitoring capabilities, network security and predictive measures across various industries.	Telcos are responding by offering more cloud, robotics, and IoT services. This is further driving network evolution through: > edge computing > software defined network > network virtualisation. Telcos are investing in data centres, higher capacity networks, fixed backhaul and subsea cables infrastructure to support managed cloud services, network slicing and massive scale IoT platforms for their customers.

Market trend	Supply chain impact
Consumption of content and data-supported services such as video streaming, social media, online gaming, remote working and mobile payments is driving demand for greater bandwidths and speeds as more activities are performed online.	Telcos continue to evolve their networks to handle data intensive services and applications more efficiently. Telcos and digital platform providers (e.g., Alphabet, Netflix, Meta) have been investing in infrastructure such as content delivery networks (CDNs), local caching servers and submarine cables to support higher volumes of video content transferred to and from Australia.

About this study

This market study helps inform our understanding of developments in the communications sector. It is part of a work program into market developments in the communications and media sectors. The study used desktop research and intelligence from third-party providers. Information is based on an illustrative sample selected to identify general industry trends and is not intended to be an exhaustive list.

We would like to thank those who provided feedback and input into this market study.

This market study forms part of the ACMA's 2022–23 research program, which supports our work as an evidence-based regulator and informs our strategic policy development, regulatory reviews and investigations.

Analytical framework

This market study identifies key trends across the consumption and output elements of the communications supply chain, from the retail market to the services and applications. The steps taken to analyse these emerging trends and identify the impact on the communications supply chain are below.

Define the supply chain component

We looked at the market structure, major participants and components for each key section of the communications supply chain.

Identify market trends

We pinpointed the emerging market trends occurring in each key section of the supply chain within Australian in the last 12–24 months. These are displayed in blue boxes throughout the report.

Analyse the emerging trends' impact on the supply chain

We linked the emerging trends for Australian markets observed in this timeframe with the impacts on and changes to the communications supply chain. This will be shown in teal at the end of each key section.

The ACMA and the Australian communications sector

The ACMA contributes to maximising the economic and social benefits of communications infrastructure, content and services for Australia. We do this by:

- maintaining, enforcing and improving regulation to drive industry performance and protect consumers
- managing public resources to enable industry to deliver existing and new services.

The ACMA plays an important role in ensuring Australians have access to the communications services they need and use.

Connectivity has become an integral part of daily life though connecting communities, remote working and providing essential services such as telehealth and education. The services and applications provided to retail consumers represents the final part of the communications supply chain market study.

Communications supply chains

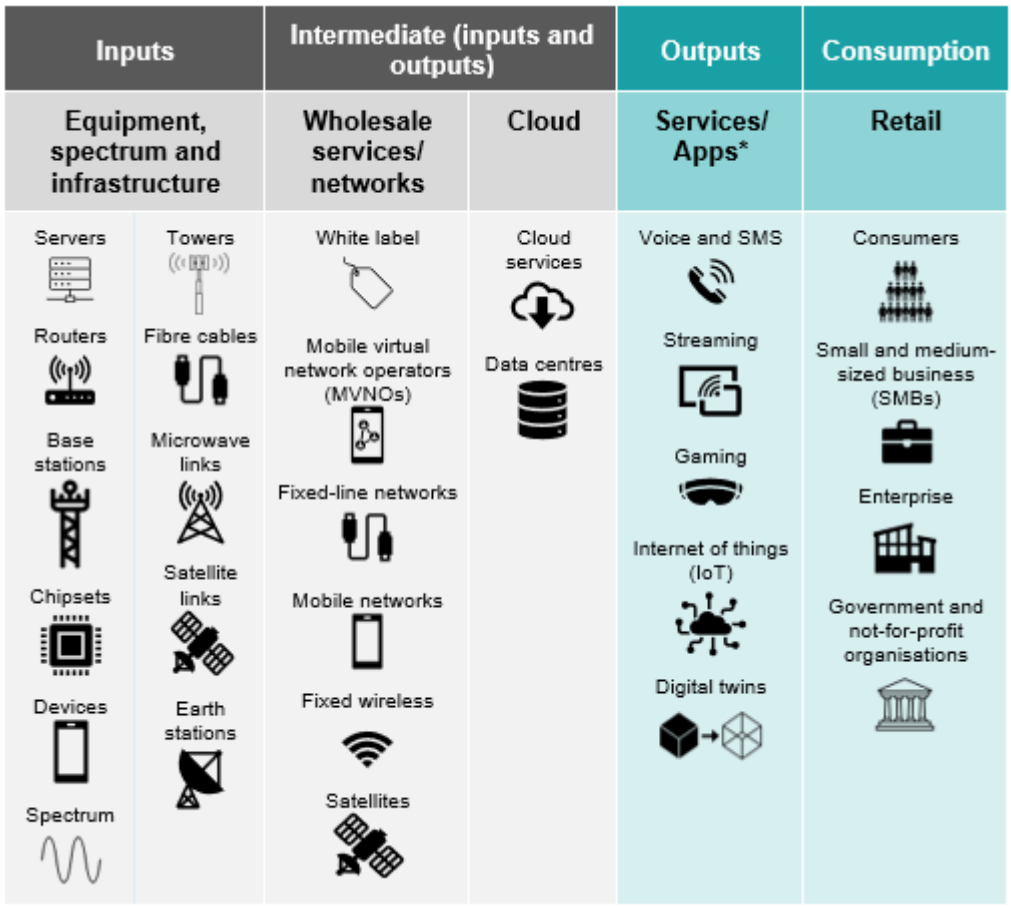
Supply chains involve inputs (for example, equipment, infrastructure and spectrum) and intermediary services (such as wholesale communication providers) to produce outputs. An output can be a product or service. Examples of outputs include voice, SMS, audio and video streaming, gaming, digital payments, digital workplace, IoT and digital twins.

There are challenges in analysing and mapping the communications supply chain:

1. Technological advances blur whether the components of the supply chain are an input, intermediary or output. For example, a cloud service could be an:
   - input, as network infrastructure used to deliver a service (for example, cloud can be used to virtualise elements of the core network for a 5G service)
   - intermediary, as a wholesale service that lies between end the user and the service provider (for example, cloud hybrid working services)
   - output, as a service or application where people can store data.
2. Competition is not static across any of the communications networks, causing upstream and downstream markets to be constantly evolving.

Figure 1 draws upon the various approaches outlined above to develop a model of the communications supply chain, with examples provided within each category.

Figure 1: Communications supply chain model



Source: ACMA analysis.

** Note the list of services and applications supplied by telecommunication services is not exhaustive. This study focuses on those that have significant impact on the telco supply chain and are primarily within the ACMA's regulatory remit.*

The inputs and intermediate elements (grey columns) were explored in Part 1: *Communications supply chain market study: From equipment and spectrum to wholesale services*.

Retail market

The retail communications market in Australia can be grouped into 4 customer segments: consumer, small and medium-sized business (SMBs), enterprise, and government.[1]

This section discusses products, market size, participants, growth strategies and consumption behaviours by retail segment.

The communications retail market supply chain impacts from a demand and supply-side perspective are summarised below, as well as an analysis of the market trends underlying these developments.

Supply chain impact: Communications retail market

Market trend impacts on the supply chain:

Demand	Supply
Consumers are increasingly relying on connectivity and expecting greater coverage across Australia.	To meet the increasing demand, telcos are expanding their network footprint and offerings to provide innovative services. Consumer expectations for reliable connectivity is leading to advancements in communication technologies. For example, satellite networks have upgraded to support 2-way messaging communication direct-to-mobiles, 5G has been deployed to 85% of the population, and broadband from low earth orbit satellites is available to homes and businesses.
Consumers are demanding greater bandwidths, speeds and connected devices.	Telcos are offering increased data allowances, higher speeds and more tailored plans. Equipment manufacturers have increased production of consumer electronics such as smartphones, Wi-Fi modems, gaming consoles and IoT sensors. Artificial intelligence is being integrated into mobile networks to improve 5G core performance and analytics.[2]

[1] Consumer, small and medium-sized business segments are discussed together due to their similar product offerings, telco suppliers and consumption behaviours. Similarly, enterprise and government segments are discussed together.

[2] Ericsson, TPG Telecom and Ericsson launch Australian-first analytics and troubleshooting solution to boost network performance for customers [media release], Ericsson.com, 14 August 2023, accessed 4 September 2023.

Enterprise and government customers are seeking ways to cut costs, scale their business and improve operational efficiencies. This is leading to greater demand for industrial automation, monitoring capabilities and predictive measures across various industries.	Telcos are partnering with industry to provide IoT and robotic services including in health, education, smart cities, manufacturing and public safety sectors. The increased uptake of IoT and robotics is driving network deployment of edge computing, including to support large scale IoT platforms. This places pressure on equipment manufacturers for chipsets, semiconductors, servers and IoT sensors. It is also driving 5G network upgrades to support cloud and edge infrastructure builds.
Demand is growing from enterprise and government customers for cyber security and services that support digital workplaces.	Telcos are addressing these demands by offering more cloud-based services. The greater use of cloud-based services is leading to investment in data centres, software defined networking and network virtualisation. Telcos are virtualising their core networks into the cloud so they can offer customers managed cloud, network slicing and cyber security services.

Consumers, small and medium business

A 'consumer' refers to individual users of communications services who use a telco product for personal, domestic or household use or consumption.[3]

In this study, SMBs refer to an entity with less than 200 employees or generates an annual income of less than $10 million.[4]

Types of consumer, small and medium business services

The main types of telco services offered to consumers include:[5]

- fixed-line phone
- mobile phone
- mobile broadband
- fixed-line broadband
- satellite broadband.

[3] Parliament of Australia, *Chapter 3: The definition of 'consumer' and the scope of the bill*, Australian Government, n.d., accessed 22 May 2023.
[4] Australian Taxation Office (ATO), *Latest estimates and trends*, ATO, Australian Government, 2022, accessed on 22 May 2023.
[5] Australian Communications and Media Authority (ACMA), *Telco consumer experience - Australian businesses: Phone and internet services*, ACMA, Australian Government, 2020, accessed 11 September 2023, p. 12.

Market trend: Innovative communication services for consumers

Consumption trend

As consumers become more reliant on connectivity, there are greater expectations on accessibility everywhere. Telcos are investing in network advancements to offer more coverage and reliable services to meet this growing demand.

Telco industry response

- Apple partnered with GlobalStar to offer direct-to-mobile emergency services communications on its iPhone 14 series. It launched in Australia in May 2023.[6]
- Optus successfully completed direct-to-mobile trials with satellite provider Lynk. Its service is due to launch in Australia in 2023.[7]
- TPG will install software in its 4G, 5G, fixed wireless and IoT networks so artificial intelligence can locate and correct network faults and analyse customer issues.[8]
- Telstra has upgraded parts of its 5G network in Queensland to manage capacity through centralised cloud computing.[9]
- Take-up rates of low earth orbit satellite broadband services have increased, with Starlink reporting 120,000 Australian customers in mid-2023.[10]

Supply chain impact

Connectivity reliance and expectations are driving satellite network and mobile device upgrades. There is strong demand for consumer satellite equipment in remote areas. There are more satellite launches planned in coming years. This includes geostationary orbit, low earth orbit and smallsats.

Equipment and network upgrades will increase demand for new chipset and semiconductor architecture. This places more pressure on the few global manufacturers. As seen during the COVID-19 pandemic, chipset demands exceeding production capacities, resulted in shortages and delays for consumers and industrial markets.[11]

The main types of telco services offered to SMBs include:[12]

- business voice (telephony)
- business mobility (mobile phone and mobile broadband)
- business-grade broadband (fixed-line, fixed wireless and satellite connections)
- Internet of Things (IoT) and edge computing

[6] Apple, *Emergency SOS via satellite available today on the iPhone 14 lineup* [media release], Apple, 15 November 2022, accessed 11 September 2023.
[7] M Williams, *Optus and Lynk complete successful LEO satellite-to-mobile test*, Optus website, November 2022.
[8] Ericsson, *TPG Telecom and Ericsson launch Australian-first analytics and troubleshooting solution to boost network performance for customers* [media release], Ericsson.com, 14 August 2023, accessed 4 September 2023.
[9] I Nikolova, *Making Australia's best 5G even better* [blog post], Telstra Exchange, 5 July 2023, accessed 4 September 2023.
[10] L Baird, *Musk's Starlink grows 20pc since Feb, charges past NBN satellite users* [news article], Financial Review, 5 May 2023, accessed 4 September 2023.
[11] J.P. Morgan, *Supply Chain Issues and Autos: When Will the Chip Shortage End*, J.P. Morgan website, 2023, accessed 11 September 2023.
[12] ACMA, *Telco consumer experience - Australian businesses*, p. 15–16.

- cloud services (storage, migration, unified communications, managed services and cyber security).

Market participants

Telstra, Optus and TPG are the largest providers of mobile and fixed services to consumers and SMB customers, accounting for 63% of the total communications market share in January 2023.[13]

These 3 companies also operate their own low-cost brands. For example, Optus owns mobile reseller Amaysim and Telstra owns mobile and fixed reseller Belong.

There is a substantial reseller market for mobile services. Boost and Aldi Mobile resell on the Telstra network, Coles Mobile and Dodo resell on the Optus network and Kogan Mobile and Lebara resell on the TPG network.[14]

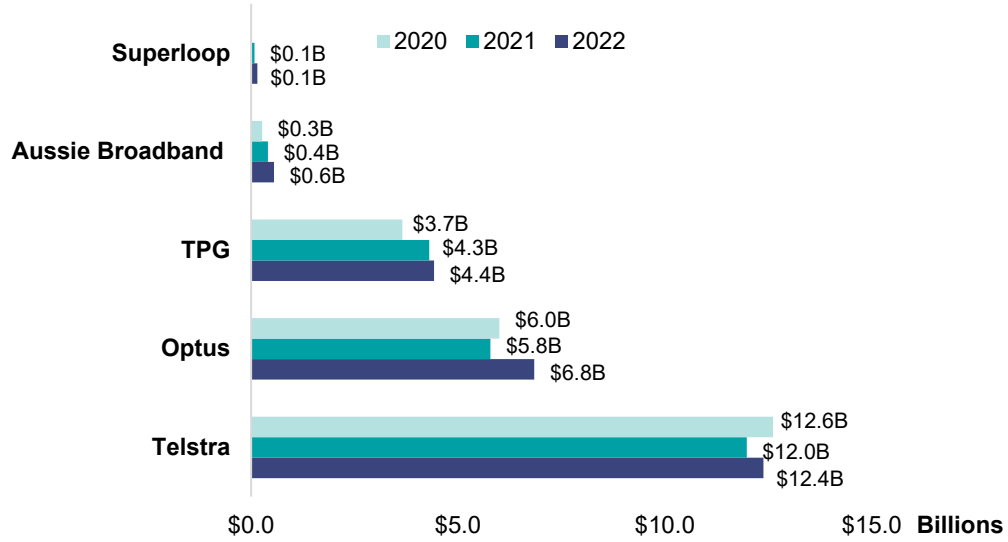
Telstra, Optus, Vocus and TPG collectively hold 85% of the market for reselling NBN fixed services.[15] The rest of the market is shared by dozens of internet resellers with Aussie Broadband and Superloop serving a significant portion, particularly at the highest speed tiers.

Over 50% of Telstra's total revenue is from the consumer and SMB retail segments.[16] For Optus and TPG, it is over 80%.[17]

Figure 2 shows the total consumer and SMB revenue on fixed and wireless services generated by the 5 largest telco providers in Australia.

[13] IBISWorld, *Telecommunications Services in Australia*, IBISWorld website, 2023, accessed 11 September 2023, p. 23–26.
[14] ACMA, *Communications supply chain market study: From equipment and spectrum to wholesale services*, ACMA, Australian Government, March 2023, accessed 11 September 2023, p. 25.
[15] Australian Competition and Consumer Commission (ACCC), *NBN Wholesale Market Indicators Report, March quarter 2023 report*, ACCC, Australian Government, 2023, accessed 9 June 2023.
[16] Telstra, *Financial results for the half-year ended 31 December 2022*, Telstra website, 2023, accessed 11 September 2023, p. 18.
[17] S&P Global, CapitalIQ Pro Platform: Singtel Optus Financials – Segment Analysis, S&P Global website (subscription), 2023, accessed 31 May 2023; TPG Telecom, TPG Full Year Results: Investor Presentation 2022 [PDF], 2023, accessed 12 September 2023, p. 34.

Figure 2: Consumer and SMB revenue by operator



Source: S&P Global, S&P CapitalIQ Pro Platform.
Note: Vocus financials are unavailable due to its privatisation in 2021.

Consumption behaviour

Consumers and SMBs have been demanding more data and faster speeds on both fixed and wireless networks. Australians are using more smart devices connected to the internet. Australian telcos have been responding to these demands by investing into their network, operations and business strategies.

Market trend: Increased appetite for data, speed & connected devices

Consumption trend

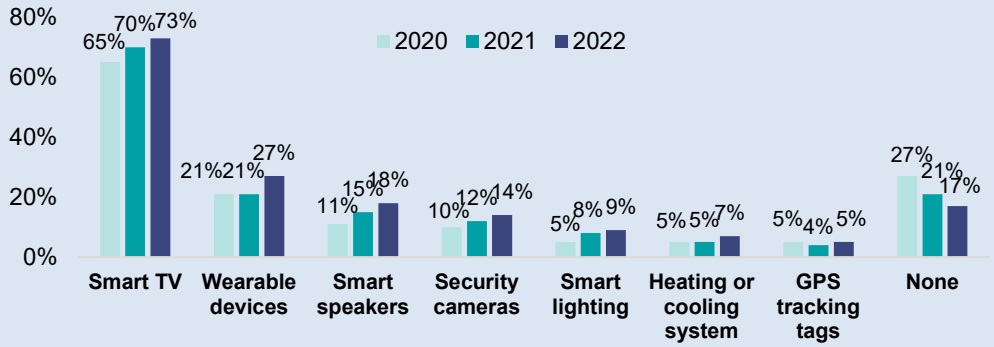
The uptake of high-speed plans (over 100 megabits per second (Mbps)) grew by 96% over a 2-year period ending June 2022. This is partly due to wholesale discounts provided by NBN for high-speed fibre connections, which allowed telcos to offer customers free speed upgrades. As more people stream high-quality videos, play games online, and connect their devices to the internet, the demand for faster speeds continues to rise.[18]

In addition, over 11.6 million terabytes (TB) of data was downloaded in Australia for the period ending June 2022. This was up from 9.8 million TB the year before, an 18% increase. Average monthly downloads over the NBN have increased from 294 gigabytes per month in 2020 to 424 gigabytes per month in 2023.[19] The increase is driven by Australians using more connected devices and consuming more data-intensive applications.[20]

Smart watches and other wearables connect to the internet through a paired mobile phone. Appliances use wi-fi linked to a fixed connection.

[18] ACCC, *Internet activity report for the period ending 30 June 2022*, ACCC, Australian Government, 2022, accessed 5 December 2022.
[19] NBN Co Ltd, *Full Year Results for FY23* [presentation], NBN Co website, 2023, accessed 5 September 2024, p. 20.
[20] ACMA, *Communications and media in Australia: How we use the internet*, ACMA, Australian Government, 2022, accessed 11 September 2023, p. 4.

Figure 3: Australia smart devices connected to the internet (June 2022)



Source: ACMA, Communications and media in Australia: How we use the internet.

Telcos industry response

Telcos have been responsive to increasing speeds and data demands by offering faster and larger data plans on both fixed connections and fixed wireless. For example:

- Telstra launched its gaming optimiser plan on fixed NBN connections, offering ultra-low latencies to reduce lags and buffering for its gaming customers.[21]
- Mobile operators have capped 5G network speeds for cheaper plans. More expensive plans are uncapped.[22]
- Optus launched a turbocharge feature, allowing customers with fixed connections to increase to the maximum speed for 24 hours, for an additional $5 fee.[23] It is also trialling this feature on its mobile network to give customers priority network access for one hour.[24]

Supply chain impact

Communications networks are investing in network upgrades to address growing data capacities and speed demands. This includes:

- upgrading mobile networks to 5G in both the core and wireless signals
- upgrading fixed equipment and infrastructure
- building fixed backhaul, fibre expansions, submarine cables and data centres.

[21] Telstra Exchange, *Telstra Game Optimiser*, Telstra website, 2021, accessed on 10 May 2023.
[22] Telstra, *Telstra Upfront Mobile Plans*, Telstra website, n.d., accessed 5 September 2023.
[23] Optus, *Turbocharge on demand: Optus Internet*, Optus website, 2023, accessed 11 September 2023.
[24] Optus, *Optus Mobile Turbocharge beta*, Optus website, 2023, accessed 5 September 2023.

Enterprise and government

A large business or enterprise refers to an entity with more than 200 employees.[25]

There are almost 5,000 large enterprises in Australia, which include public, private and foreign-owned companies, non-for-profit organisations, partnerships, trusts and super funds.[26]

Types of enterprise and government services

The main types of telco services offered to enterprises and government include[27]:

- business voice (telephony)
- business mobility (mobile phone and mobile broadband services)
- business-grade broadband (fixed-line, fixed wireless and satellite connections)
- IoT, digital twins and edge computing
- cloud services (storage, migration, unified communications, managed services and cyber security).
- private network services (build and manage).

Market trend: Greater uptake in IoT across industries

Consumption trend

Enterprise and government agencies are seeking ways to improve their business procedures. This includes demanding automation, monitoring and predictive measures to improve operational efficiencies. New technologies are being introduced in health, education, smart cities and public safety applications.

Telco industry response

Telcos are partnering to create large-scale IoT platforms and robotics services for enterprise and government customers. For example:

- Telstra IoT services increased by 660,000 in the first half of 2023. IoT now accounts for 6.3 million services in operation on its network. [28]
- Yarra Valley Water partnered with TPG to deploy a massive-scale IoT device platform of up to 1 million sensors across its 20,00 km pipe network. The smart devices will gather data on water flow, pressure and quality to improve service reliability and responsiveness, as well as reduce wastage.[29]
- Optus has partnered with Ericsson and Universal Robots to replace fixed wire connectivity with wireless 5G.[30]

[25] Australian Bureau of Statistics (ABS), *Australian Industry: Business size*, ABS, Australian Government, 2018, accessed 23 May 2023.
[26] ABS, *Counts of Australian Businesses, including Entries and Exits* [.xlsx], ABS, Australian Government, 2023, accessed 4 May 2023.
[27] Telstra, *Government, Business & Enterprise Solutions from Telstra*, Telstra website, n.d., accessed 15 May 2023.
[28] Telstra, *Financial results for half-year ended 31 December 2022: Supporting material* [PDF], 2023, accessed 11 September 2023.
[29] TPG Telecom, *TPG wins massive-scale IoT device contract with Yarra Valley Water* [media release, PDF], TPG Telecom website, 22 February 2022, accessed 11 September 2023.
[30] C Mitchell, Australian 1st demo of 5G mmWave URLLC for enabling advanced automation, Optus website, 2022, accessed 11 September 2023.

Supply chain impact

The increased use of IoT and robotics is driving network evolution towards edge computing, to achieve near real-time machine to machine (M2M) communication.

As a result, equipment manufacturers have been producing more IoT sensors, cloud-computers nodes, routers and servers. In addition, the greater uptake in IoT and robotics is attributed to the data centre growth in Australia, which supports data storage and computing occurring at the edge of networks.

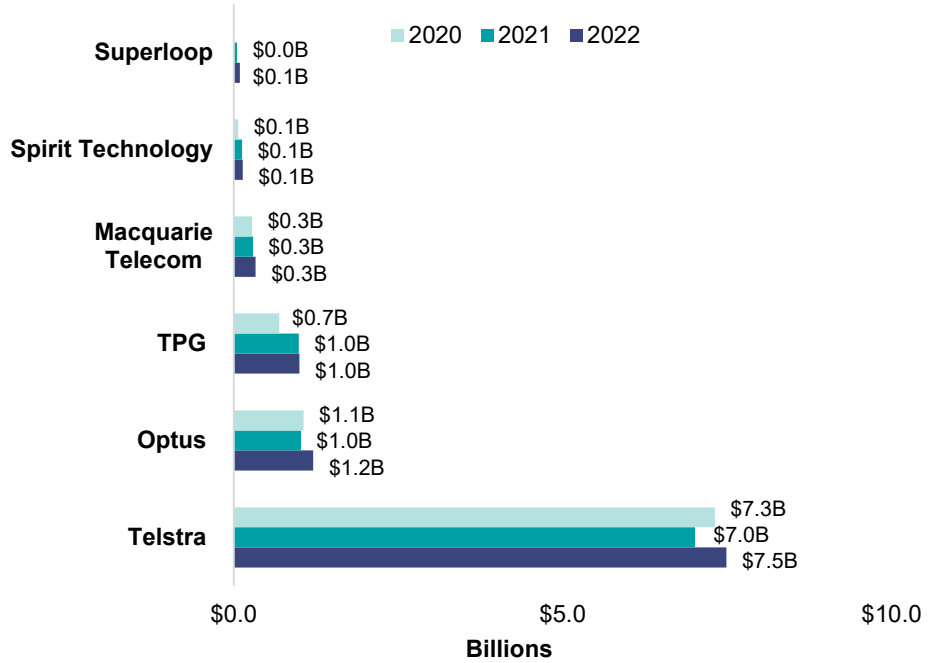
Market participants

Telstra, Optus TPG and Vocus are the largest providers of telco services to enterprise and government customers. Smaller telco operators have recently been targeting this segment in the fixed market.[31]

Telstra and Vocus Satellite have partnered with Starlink, to provide new satellite services for businesses.[32] The Starlink offers enterprise and government customers with voice and high-bandwidth, low-latency broadband connections.[33]

Similarly, GigaComm and Uniti Group have upgraded their fibre infrastructure to offer business-grade speeds for their enterprise and government customers.[34]

Figure 4: Enterprise and government revenue by telco operator



Source: S&P Global, S&P CapitalIQ Pro Platform.
Note: Vocus financials are unavailable due to its privatisation in 2021.

[31] C Hammond, *Australian challenger operators rapidly gain share in the B2B market* [PDF], Analysys Mason website, 2022, accessed 11 September 2023.
[32] Telstra, *Telstra announces agreement with Starlink* [media release], Telstra website, 3 July 2023, accessed 11 September 2023.
[33] Vocus, *Vocus signs with SpaceX to provide Starlink Business to customers*, Vocus website, 2022, accessed 11 September 2023; GigaComm, *GigaComm secures $20.5 million in funding for infrastructure expansion* [media release], 24 June 2022, accessed 11 September 2023.
[34] ACCC, *Communications market report 2021–22*, ACCC, Australian Government, 2022, accessed 11 September 2023, p. 6.

Consumption behaviour

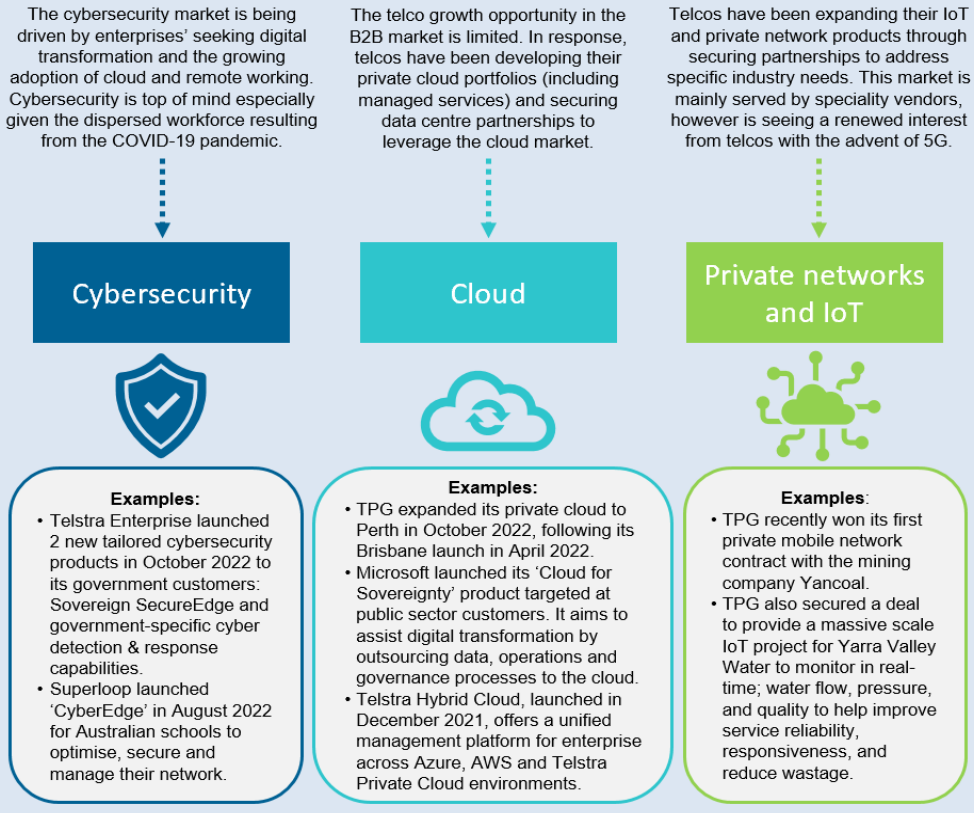
The key factors enterprises and government seek from telcos include speed, reliability, appropriate pricing, ability to promptly rectify network faults and good customer service.[35] Australian telcos have designed business-grade plans to cater for the needs of enterprise and government customers. This includes establishing new services in network adjacent areas such as cloud, edge computing, cyber security, systems integration and industrial automation.[36]

Market trend: Cloud adoption by enterprises and government

Consumption trend

Cloud computing was used by most Australian enterprises (90%) in 2022.[37] It has become widely used by enterprises and government to scale their business, increase efficiencies, reduce costs and improve security.[38]

Industry analysts have identified cloud, cyber security, IoT and private networking as growth areas for Australia's enterprise and government agencies.[39]



Source: ACMA and GlobalData analysis.

[35] ACMA, *Telco consumer experience - Australian businesses*, p. 2.
[36] GSMA, *The telecoms industry in 2023: Trends to watch* [PDF], GSMA website, 2023, accessed 11 September 2023, p. 8.
[37] Australian Bureau of Statistics (ABS), *Business use of Information & Communication Technologies*, ABS, Australian Government, 2022, accessed 22 June 2023.
[38] Deloitte Australia, *The economic value of cloud services in Australia* [PDF], Deloitte website, 2019, accessed on 15 April 2023, p. 5.
[39] GlobalData, *ASEAN Telecom Enterprise ICT 2023 Predictions*, GlobalData website (subscription), 2023, accessed 23 January 2023.

Telco industry response

Telcos and hyperscalers provide most of the cloud services used by enterprises and government customers in Australia:

- Amazon Web Services won the contract to supply the NSW Government public cloud services in May 2022.[40]
- Macquarie Telcom has renewed its cyber security contract with the ATO in January 2023. This includes providing cloud services to support the secure management of the ATO's IT environment and internet connections.[41]

Supply chain impact

The increased adoption of cloud is driving investment in software-defined networking, network virtualisation and data centres. For example, an additional 894 megawatts of capacity for data centres was announced in 2022.[42] Networks operators seek to reduce their infrastructure by virtualising their core networks into the cloud.[43] This approach assists in supporting managed cloud, network slicing and cyber security services for their customers.

[40] NSW Government, *Customer Service / Amazon Web Services for Cloud Services (AWS) - DICT/11517*, tenders.nsw.gov.au, 2022, accessed 11 September 2023.
[41] Macquarie Telecom, *ATO Renews Cyber Security Contract with Macquarie Government*, Macquarie Government website, 2023, accessed 31 January 2023.
[42] Venture Insights, *Australian Data Centres Outlook*, Venture Insights website, 2022, accessed 11 September 2023.
[43] Network virtualisation is the process of reducing a telco's hardware, by moving its core network infrastructure into the cloud.

Services and applications

The following section examines developments in services and applications (apps). Some services and apps such as voice and SMS are supplied directly by telcos to customers as part of their network functions. Others, such as streaming, social media and gaming, require network connectivity generally supplied by over-the-top (OTT) providers. Impacts of these developments on the supply chain are discussed in greater detail at the end of the chapter.

Supply chain impact: Services and applications

Market trend impacts on the supply chain:

Demand	Supply
Consumers are shifting from traditional voice and SMS, which uses a telco's network, to equivalent data-based messaging and audio services (such as WhatsApp, Skype, iMessage and Facebook Messenger). Businesses are moving towards VoIP and data-supported video and audio services to support workplace operations.	Telcos are responding to greater connectivity demands with larger data plans, switching to voice over Wi-Fi calls and offering more VoIP services to businesses. Further 5G network upgrades in 2023, expanding coverage and capacities, aims to address the increasing network traffic across Australia. This includes upgrades and builds to radiocommunication infrastructure (towers or cells, sites, fibre links) and equipment (base stations, routers, antennas).
Australians are increasingly consuming data-intensive activities such as video streaming and gaming services.	Telcos have begun offering free social media browsing plans, OTT-optimised plans and their own SVOD offerings to attract more customers to their network. Digital platform providers and Australian networks have been investing in content delivery networks (CDN) infrastructure, local caching and submarine cables. This supports higher volumes of video content transferred to and from Australia.
There is a shift in consumption from traditional console and PC-based hardware gaming to internet-reliant gaming (cloud and eSports). Gaming customers are therefore demanding higher speed plans and low latency connections to improve the visual experience and reduce buffering and lags.	Telcos are now offering consumers specialised gaming speed plans and providing enterprises with bespoke connectivity to stream and connect eSports competitions. Digital platforms and networks have invested in cloud infrastructure (data centres, servers and submarine cables) as well as network upgrades (5G, fibre backhaul), to support more cloud gaming and eSports competitions. Equipment manufacturers have increased production

	of consumer electronics such as gaming wi-fi modems, routers and consoles.
The increasing preference in mobile payments (via mobile sites, apps, QR codes and mobile wallets) is driving growth in digital payments in Australia.	Telcos have partnered with the finance industry to supply and support digital payment services, via cyber security services (digital ID verification, multi-factor authentication, fraud detection). Greater cyber security demands for digital payments have led to a greater reliance on edge computing. This increases the demand for data centres, edge computing nodes, IoT sensors and connected devices (smartphone, smartwatch, fitness trackers).

Voice and SMS services

Voice and Short Messaging Service (SMS) are commonly used telco services that provide communications to customers. Mobile calls have the highest use of all forms of communication, greater than email and messaging.[44]

Voice and SMS services are mainly supplied by local telcos and digital platforms in Australia. Consumers continue to use more data-supported applications (apps) for these services rather than those supplied by the local telcos. This includes apps such as WhatsApp, iMessage, Facebook Messenger and Signal.

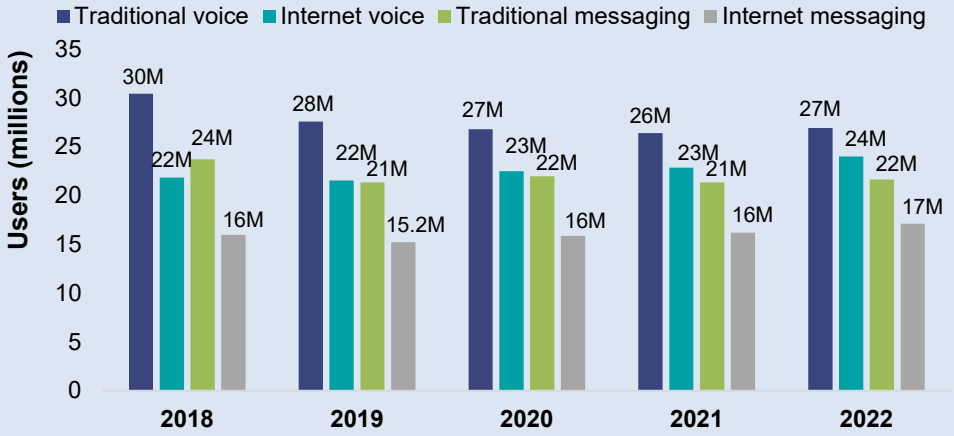
Market trend: Data-alternatives replace traditional telco services

Consumption trend

The increased adoption of smartphones and 5G has given users wider access to data-based voice and messaging apps. These apps allow for cheaper and often better-quality communication as well as features such as domestic and international calls using data instead of phone charges.[45] Businesses are also moving towards voice over internet protocol (VoIP) and data-supported video and audio services to support workplace operations.[46]

[44] ACMA, *Communications and media in Australia: How we communicate*, ACMA, Australian Government, 2022, accessed 11 September 2023, p. 1.
[45] ACCC, Digital Platforms Inquiry – Interim Report, ACCC, Australian Government, 2022, accessed 15 April 2023, p. 10.
[46] VoIP uses a wireless, cloud-based system that transmits voice digitally over the internet, whereas voice transmits voice into analogue signals through a copper wire connection to the service provider central office.

Figure 5: Australian traditional vs. data-supported voice and messaging



Source: GlobalData, Australia Fixed Communications Forecast and Australia Mobile Broadband Forecast.

Data-supported communication has been displacing traditional voice and SMS services (both mobile and fixed) since 2015. [47] It is seen as an effective substitute rather than a complementary service.[48]

Telco industry response

Australia's major voice and SMS providers (Telstra, Optus, TPG Telecom and Vocus) are responding to greater connectivity demands through larger data plans, switching to voice-over-wi-fi calls and offering more VoIP services to businesses:

- Telstra defaults to voice-over-wi-fi for customers. This allows for better quality calls in locations where a signal from wi-fi is stronger than from mobile towers.49
- Vocus launched its cloud-based, VoIP calling solution 'Vocus Calling' for enterprise and government customers.[50]

[47] Ofcom, *Declining Calls and Changing Behaviour* [PDF], Ofcom, UK Government, 2020, accessed 11 September 2023, p. 4.
[48] ITU, *Economic impact of OTTs on national telecommunication and ICT markets*, ITU website, 2020, accessed 11 September 2023, p. 5.
[49] Telstra, *What is Wi-Fi calling and SMS?*, Telstra website, n.d., accessed 15 April 2023.
[50] Vocus, Vocus launches calling platform for leading collaboration solutions [media release], Vocus website, 21 November 2021, accessed 11 September 2023.

Over-the-top (OTT) services

OTT services are standalone products delivered over the internet. They include web browsing, video streaming, audio streaming, messaging, and social media services.

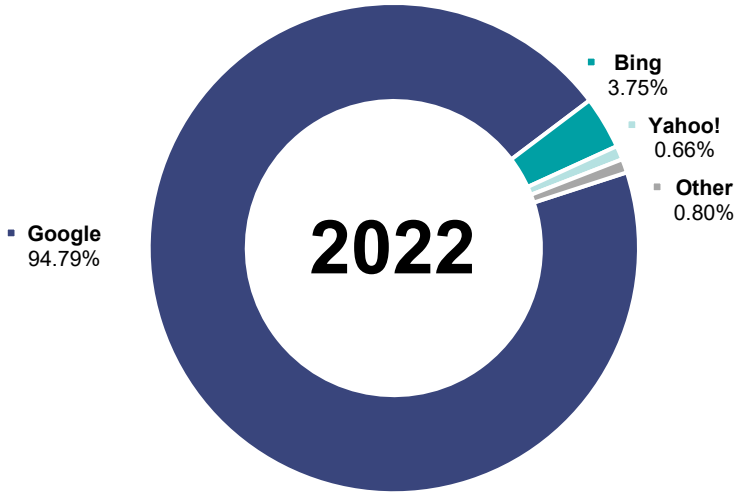
OTT providers are often referred to as digital platforms. Digital platforms leverage local connectivity to offer their services in different markets. This contributes to network traffic.[51]

Digital platforms are a key source of news and information for many Australians. They have also become a source leading to the increased spread of harmful misinformation. This includes disinformation – false and misleading information distributed by malicious users with the intent to cause harm to individuals and the broader community.[52]

Web browsing

Web browsing involves accessing the internet via a search engine. Consumers use this service primarily for information gathering. In Australia, the major search engines include Google, Bing, Yahoo and DuckDuckGo. The market share of these search engines has remained stable for over a decade.[53]

Figure 6: Market share of search engines in Australia



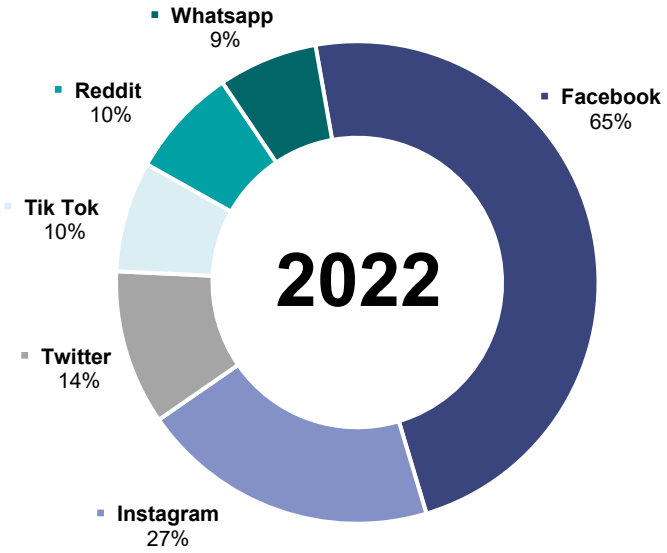
Source: Statcounter, Search engine market share.

Social media platforms

Social media platforms are digital channels enabling users to consume, create and share content with virtual communities. This content includes personal information, documents, news, photos and videos. Most Australians (87%) used social media for communication in 2022.[54]

[51] ACCC, Digital Platforms Services Inquiry [PDF], ACCC, Australian Government, 2022, accessed 11 September 2023, p. 31–32.
[52] ACMA, *Misinformation and news quality on digital platforms in Australia*, ACMA, Australian Government, 2020, accessed 3 June 2023, p. 1.
[53] Statcounter, Search engine market share, Statcounter website, 2023, accessed 30 June 2023.
[54] ACMA, Communications and media in Australia: How we communicate.

Figure 7: Social media platforms used by Australians to communicate



Source: ACMA, Communications and media in Australia: How we communicate.

Streaming

Streaming involves viewing or listening to video or audio content over the internet. Australian telcos provide the connectivity to run various streaming services. The different service types include:

- video on demand
- live video streaming[55]
- audio streaming.

Video streaming

There are different types of video streaming business models in Australia offered by different providers, as shown in Table 2.[56]

Table 2: Types of video streaming

Video streaming type	Description	Examples of providers
Subscription video on demand (SVOD)	SVOD offers subscribers access to a library of content to stream on demand for a recurring fee	Netflix, Disney+, Stan, Binge, Amazon Prime Video and Paramount+
Advertising supported video on demand (AVOD)	AVOD is like SVOD but is accessed for free or at a lower price in exchange for watching advertising	Netflix, YouTube and Tubi

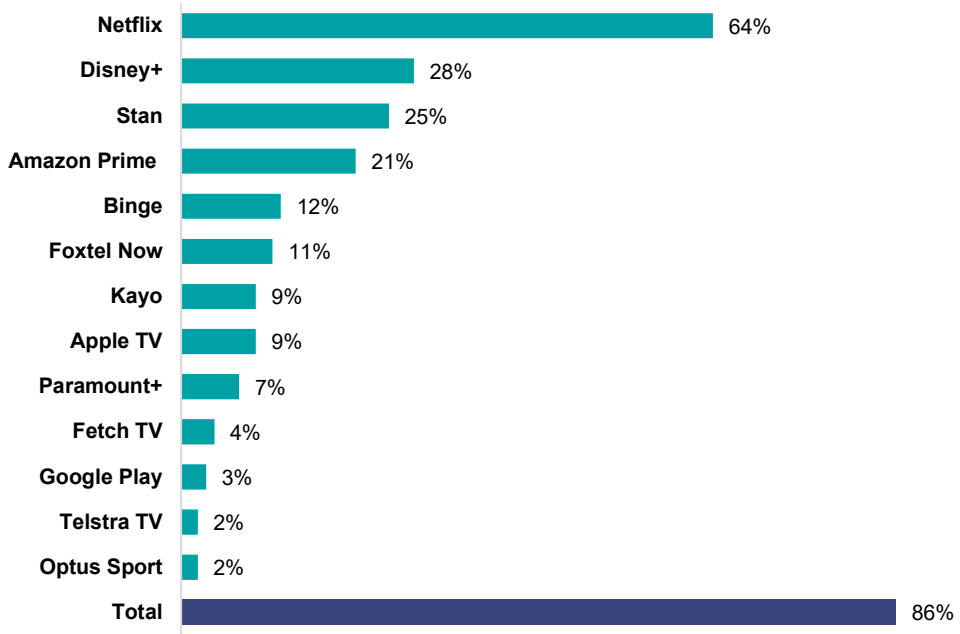
[55] Live streaming is not considered a video on-demand service as it involves broadcasting an event over the internet as it's taking place, even if viewed on a subscription video on demand service.
[56] Screen Australia, *Online and on demand: Trends in Australian video use*, Screen Australian, Australian Government, 2014, accessed 12 April 2023, p. 5.

Video streaming type	Description	Examples of providers
Broadcast video on demand (BVOD)	BVODs offers content that is generated from TV broadcasters to stream on demand, including free ad-supported television channels	10Play, 9Now, 7Plus, SBS On Demand and ABC iview
Transactional video on demand (TVOD)	TVOD allows consumers to pay for access to content for a limited period (generally 48 hours for a new-release film) or to download onto a local device	Apple TV, Fetch TV and Telstra TV

Source: ACMA analysis. The list of providers is not exhaustive.

Most Australians (76% of households) are subscribed to at least one SVOD service.[57] See Figure 8 for the major SVOD services in Australia.

Figure 8: Australians' use of SVOD services (in the past 7 days)



Source: ACMA, Communications & media in Australia: How we watch and listen to content.

[57] GlobalData, *Australia Subscription Video on Demand (SVOD) Forecast*, GlobalData website (subscription), 2023, accessed 19 April 2023.

Market trend: New ad-supported SVOD products in Australia

Consumption trend

In early 2023, cancellation rates for SVOD services remained high, with 1.2 million services terminated between January and March 2023. This is expected to increase, with 23% of households planning to cancel a service in the next 3 months.[58]

The trend is a result of the market reaching saturation, strong competition for content, and economic pressures placing strain on consumer budgets.[53]

In response, SVOD providers are now offering ad-supported viewing plans at a cheaper price. Netflix first introduced the lower priced, ad-supported plan in November 2022, with other operators following suit; Disney+ in December 2022, Foxtel's BINGE in April 2023 and Paramount+ later in 2023.[59]

Telco industry response

Australian telcos are providing optimisation features and faster speeds to enhance video streaming performance for customers:

- Telstra offers its 'Internet Optimiser' feature at no extra cost, which allows its customers to prioritise traffic towards activities such as video streaming.[60]
- Exetel markets its superfast NBN fixed plan (225 Mbps), targeted at supporting video streaming and gaming activities.[61]

In response to growing competition pressures, telcos are offering entertainment bundles to retain customers and to attract new customers to their network. Bundling has the benefit of convenience, with aggregation services (Telstra TV, Fetch TV and Optus SubHub) allowing customers to better manage their subscriptions and pay for their services on their telco bill.

Some telcos have also launched their own content offerings. For example, Optus Sport is an Optus initiative to diversify its offerings and increase its market share through exclusive sports content.[62]

The rise in popularity of SVOD services and the number of providers has contributed a major increase in traffic (40% p.a.) on networks. Significant investment is required to cater for the increased demand of larger bandwidths.[63] Internationally, telcos are requesting OTT providers to contribute to the costs of carrying this additional traffic.[64]

[58] Kantar, *Australian streaming market stabilises despite 1.2 million cancellations*, Kantar website, 2023, accessed 1 May 2023.
[59] G Peters, We are launching 'Basic with Ads' our lower priced ad-supported plan [media release], Netflix, 14 October 2022, accessed 22 October 2022.
[60] Telstra, *Prioritise your internet for what matters most*, Telstra website, n.d., accessed 15 May 2023.
[61] Exetel, *Streaming and gaming bliss with our Superfast nbn plan 225 Mbps*, Exetel website, 2023, accessed 15 May 2023.
[62] Optus, *Optus Sport secures exclusive rights for the Spanish football league LaLiga* [media release], Optus website, 27 June 2022, accessed 11 September 2023.
[63] Optus, *CommsDay Summit 2022 Sydney - Andrew Sheridan address*, Optus website, 2022, accessed 11 September 2023.
[64] F Y Chee, *EU riles Big Tech with telecoms network costs consultation*, Reuters website, 2023, accessed 11 September 2023.

Audio streaming

Audio streaming services provide on-demand audio content through a network connection to consumer devices: smart speakers, tablets, computers, smartphones and smart TVs. The 3 main types of audio streaming services include:

- podcasts
- online radio
- music streaming.

Podcasts generally provide audiences news, lifestyle, storytelling and catch-up content. Spotify, YouTube and Apple dominate podcast listening, while the ABC Listen app is the most-used local source, followed by Acast and SCA's Listnr apps.[65]

Similarly, music streaming providers (Spotify, Apple Music, YouTube, Amazon Music, SoundCloud) and online radio (iHeartMedia, TuneIn) are mainly used to consume music and news. While online radio offers similar capabilities to traditional radio services, music streaming apps offer audiences music on demand, larger audio libraries, discovery features and tailored playlists.[59]

Audio streaming services generally requires customers to subscribe to a platform for a monthly fee. Alternatively, these services can be accessed for free if supported by advertising. They do not require large amounts of data to use but contribute to the overall traffic on Australian networks.

Network operators have previously partnered with music streaming platforms to offer unmetered, data-free audio. For example, Telstra offered data-free streaming of Apple Music while Optus offered the same with Spotify.[66]

Gaming

5G services have increased data capacities and speeds, accelerating growth in the Australian gaming market. Lower latency internet improves the visual experience and reduces buffering and lags for reliable high-speed gaming connections.[67] This is becoming a key point of difference among service providers for gaming customers.[68]

The main types of gaming that requires an internet connection, either for online gaming or downloading games onto local devices, include:

- computer
- console
- mobile
- cloud.

[65] PwC, *Entertainment and Media Outlook 2022 – Listen*, PwC website, 2022, accessed 11 September 2023.
[66] Telstra, *Telstra and MOG to bring unlimited music streaming to Australia* [media release], Telstra website, 11 April 2012, accessed 11 September 2023.
SBS News, *Optus offers data-free music streaming* [media release], SBS website, 19 May 2016, accessed 11 September 2023.
[67] Ericsson Australia, *5G by Ericsson*, Ericsson website, n.d., accessed 8 February 2022.
[68] Venture Insights, *PlayStation & Xbox left behind: 5 themes for the 2022 games industry*, Venture Insights website, 2022, accessed 11 September 2023.

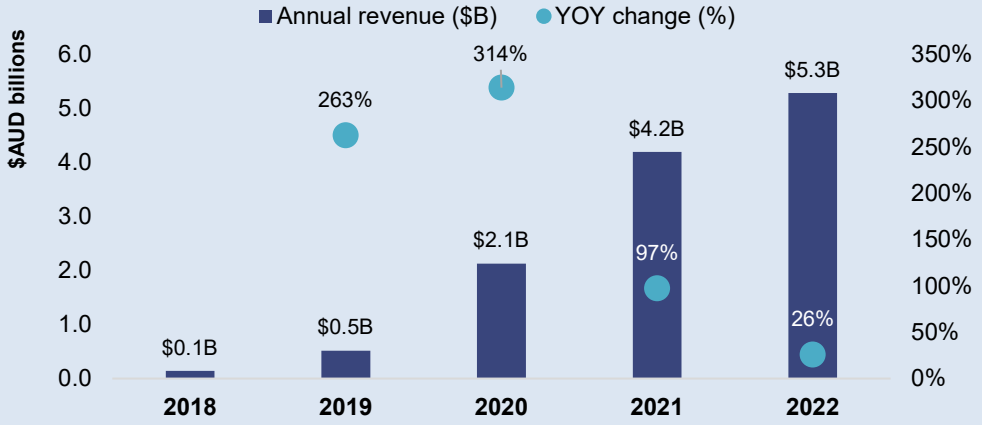
Market trend: Shifts towards cloud, mobile gaming and esports

Consumption trend

There is a shift from console to cloud gaming both in Australia and globally. This is a trend towards a more internet-reliant type of gaming. Instead of downloading and installing games on a computer or console, cloud gaming streams from an online library of games, using remote servers in data centres. A benefit of cloud gaming is avoiding supply shortages, which impacts gaming consoles and computers.[69]

Similar to cloud gaming, use of virtual and augmented reality gaming increased in recent years.[63] These gaming styles use high quality, low latency video rendering capabilities that require larger data capacities and faster speeds.

Figure 9: Global cloud gaming revenue



Source: S&P Market Intelligence, 'Cloud gaming forecast to grow market share'.

Mobile gaming accounted for 42% of Australia's video game market in 2022.[70] The Australian market for eSports is expected to grow by 8.2% in 2023 to 2.5 million users. eSports refers to organised multiplayer video game competitions, usually involving professional players.[71]

Telco industry response

Telcos now offer dedicated gaming speed plans and connectivity to stream and connect eSports competitions:

> Optus Game Path[72] and Aussie Broadband's NBN for gamers[73] focuses on providing low-latency connections to reduce buffering and lags due gameplay.

> Telstra partnered with Fortress Australia and Riot Games to facilitate large scale eSports tournaments operating in Australia.[74]

[69] S&P Global, *Game-console makers eye diversification; APAC box office revenue dips*, S&P Global website (subscription), 2022, accessed 11 September 2023.
[70] GlobalData, *Australia Gaming Software Forecast*, GlobalData website (subscription), 2023, accessed 11 September 2023.
[71] GlobalData, *Thematic Intelligence: Esports*, GlobalData website (subscription), 2022, accessed 11 September 2023.
[72] Optus, *Game Path. Your secret weapon against lag*, Optus website, n.d., accessed 16 November 2022.
[73] Aussie Broadband, *The NBN network built for gamers, by gamers*, Aussie Broadband website, n.d., accessed 16 November 2022.
[74] Z Kelly, This Is the Telstra Lounge a Public PC Gaming Space in Sydney, Gizmodo, 4 April 2023, accessed 12 September 2023.

> Pentanet and Optus have partnered with NVIDIA to deliver its cloud gaming service 'GeForce Now' and eSports team GG.Pentanet.[75]

Digital workplace

Australian businesses have invested heavily in technology to facilitate remote working.[76] Reliable connectivity is a digital workplace requirement, with networks managing increased home broadband traffic.

Cloud-based services are providing a wide range of functions for communications (virtual meetings, voice communication and chat functions) and collaborative tools (Microsoft 365 software, Google Drive, Dropbox).

Australian telcos have been partnering with industry to provide cloud-based communications services, as shown below.

Market trend: Rise of communications platforms as a service

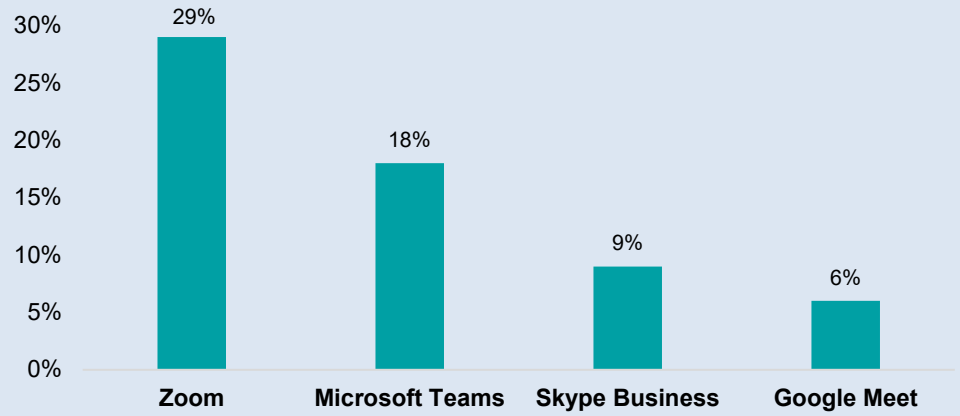
Consumption trend

Communications platform as a service (CPaaS) refers to a cloud-based service that provides real-time communications capabilities, such as voice, messaging, video and business applications.

The COVID-19 pandemic changed work practices. Employees moved to remote working, and business travel was replaced with virtual meetings. In the 6 months to June 2022, 45% of employed Australian adults worked from home.[77] CPaaS are now used to host communication sessions in the cloud and deliver them to any remote location in real time.

The major CPaaS providers include Microsoft's Skype and Teams, Zoom, Cisco's Webex, Facebook's Workplace and Google's Workspace.

Figure 10: Communications platforms used in Australia (June 2022)



Source: ACMA, Communications and media in Australia: How we communicate.

[75] Optus, *Optus & Pentanet Announce 5G Cloud Gaming Partnership* [media release], Optus website, 7 March 2023, accessed 12 September 2023.
[76] R Riad, *CPaaS: The key takeaways from WebexOne 2022*, Webex Blog website, 2022, accessed 12 September 2023.
[77] ACMA, Communications and media in Australia: How we use the internet.

As more organisations seek greater workplace collaboration, operational efficiencies, network security and reduced IT infrastructure and hardware costs, CPaaS has grown in popularity.

Telco industry response

Australian telcos are using CPaaS to support their enterprise and government:

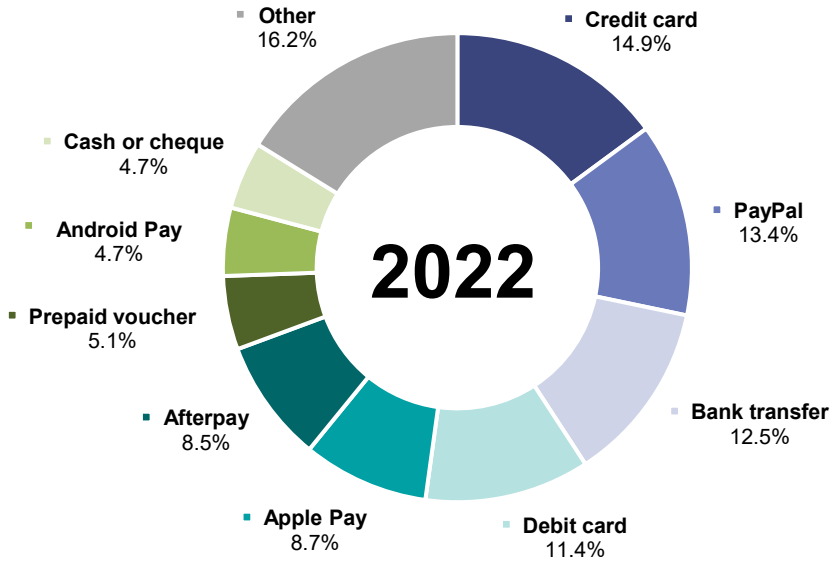
- Telstra assisted Moreton Bay Local Council in its digital transformation using Microsoft Azure cloud migration services and Microsoft 365 collaboration tools.[78]
- TPG partnered with Master Builders Victoria to lead their digital transformation using a range of CPaaS products such as its new Software-defined Wide Area Network (SD-WAN) security solution.[79]

Digital payments

Similar to many sectors of the Australian economy, the finance industry has shifted towards a digital ecosystem. Connectivity is a key element for online banking services, with retail customers requiring secure network connections to enable digital transactions.

Over 90% of Australian relied on an internet connection for online banking in 2022.[80] In early 2023, digital payments represented half of the total payments in Australia.[81]

Figure 11: Australia's spread of payment instruments in 2022



Source: GlobalData, Australian Commerce Data: Q3 2022.

The security of online banking is critical for financial companies to protect customers' financial information, prevent fraud and comply with regulations.

[78] Telstra, *How cloud telephony supports a more collaborative future at Moreton Bay Regional Council*, Telstra website, 2021, accessed 12 September 2023.
[79] TPG Telcom, TPG Telecom partners with Master Builders Victoria TPG Telecom website, 1 February 2022, accessed 12 September 2023.
[80] University of South Australia and ANZ, *Exploring digital capability in older Australians*, ANZ website, 2022, accessed 12 September 2023, p. 6.
[81] GlobalData, Payment Trends for 2023, Global Data website (subscription) 16 January 2023.Accessed 15 March 2023.

Market trend: Mobile commerce drives digital payments

Consumption trend

Advancements in mobile platforms has led to most digital payments occurring on mobile devices. Apps, QR codes and mobile-based sites have become more accessible and able to handle tasks that were previously only capable on laptops.[75]

Government agencies, utility companies, schools and smaller entities have launched their own apps to enable mobile payments. The growing acceptance of mobile payments has enabled Australians to switch to mobile wallets with ease.[75]

The number of Australians using a mobile digital wallet (such as Apple Pay and CBA Tap & Pay) has more than doubled between March 2020 and 2022, from 10% to 25%.[82]

Telco industry response

Australian telcos are also working with finance companies to supply and support digital payment services:

- Telstra offers small business customers access to Tyro's online EFTPOS payment services to allow for secure online payments and technology that seamlessly links with other digital tools.[83]
- Optus has partnered with Westpac to apply blocks to prevent scammers using call spoofing software, aimed at reducing scams and financial harm to its banking customers.[84]

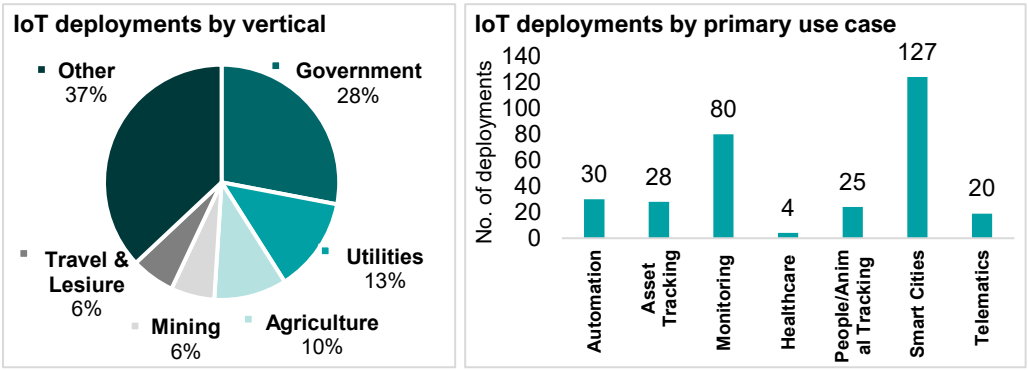
Internet of things (IoT) and digital twins

While not limited to any specific technology platform, industry, object or device, IoT relates to multiple wireless and wired interconnections of personal, consumer and industrial devices supporting a diverse range of applications.[85]

Different sectors are using IoT in Australia (see Figure 12). The main uses of IoT include automation, asset tracking, monitoring and smart cities applications. There are 316 deployments of IoT in Australia at June 2023.[86]

[82] Reserve Bank of Australia (RBA), *Payments System Board Annual Report 2022*, RBA website, 2022, accessed 12 September 2023.
[83] A Da Cunha, *Enabling EFTPOS for Aussie small business with Tyro through Telstra*, Telstra website, 2022, accessed 12 September 2023.
[84] Westpac, *Westpac releases real-life scam call as cases spike* [media release], 2022, accessed 12 September 2023.
[85] ACMA, *Internet of Things in media & communications: Occasional paper*, ACMA, Australian Government, 2021, accessed 8 June 2023, p. 1.
[86] GlobalData, *IoT Deployment Tracker*, GlobalData website (subscription), 2023, accessed 28 March 2023.

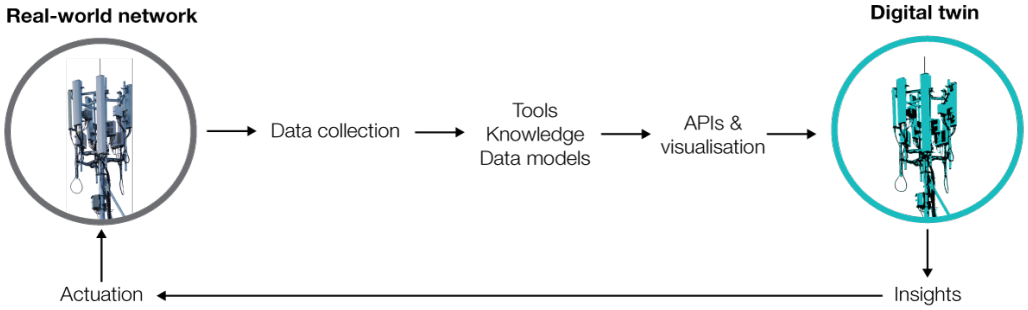
Figure 12: Australian IoT deployments by vertical and primary use case



Source: GlobalData, IoT Deployment Tracker.

A digital twin is a virtual representation of a physical asset. It uses real-time data to connect the physical and digital worlds. A digital twin relies on IoT sensors to detect, predict and optimise physical environments. [87] They are generally used as a mapping or modelling tools for businesses.

Figure 13: Digital twin process



Source: ACMA analysis.

IoT and digital twins work together and can have similar purposes, such as preventing and predicting network and system issues. However, digital twins can be used to run scenarios on a prototype to understand the likely problems. IoT smart devices detect problems only after they happen.

[87] GlobalData, *Thematic Research: Technology – Digital Twins*, GlobalData website (subscription), 2023, accessed 18 December 2022.

Market trend: Growth in large IoT and digital twins projects

Consumption trend

More enterprise and government customers are using IoT and digital twins. The increasing availability of smaller, more accurate, and cost-effective sensors is driving up production volumes and demand for 'smart' IoT devices.[88]

Greater IoT commercialisation is fuelling demand for new chipset architecture that offers higher bandwidth data transmission.[89] Technology advancements such as 5G and AI are supporting greater IoT deployments as lower latency and stability can facilitate more efficient M2M communication, across massive numbers of mobile or static devices.[90]

Telco industry response

Telcos have partnered with several enterprise and government customers to provide IoT platforms and digital twins:

- Optus partnered with Thinxtra to supply IoT courier tracking service to CourierPlease. The tracking feature uses IoT devices on packages across vast distances, to transmit location information so there are no lost parcels.[91]
- Telstra launched an industrial automation service to enable greater use of IoT technologies paired with 5G and AI, in industries such as mining, construction, supply chain, and manufacturing.[92]
- The Queensland Government created a digital twin to plan for Brisbane's 300 km Cross River Rail infrastructure project.[93]

[88] F Dahlqvist, M Patel, A Rajko and J Shulman, *Growing opportunities in the Internet of Things*, McKinsey & Company website, 2022, accessed 12 September 2023.
[89] GlobalData, *Thematic Research: Internet of Things*, GlobalData website (subscription), 2021, accessed 12 September 2023, p. 41.
[90] Qualcomm, *Qualcomm Introduces Cutting-Edge IoT Solutions* [media release], Qualcomm website, 17 April 2023, accessed 12 September 2023.
[91] Thinxtra, *CouriersPlease reduces parcel losses with Optus and Thinxtra-powered IoT roll cage tracking*, Thinxtra website, 2023, accessed 12 September 2023.
[92] Telstra, *Telstra launches Industrial Automation capability to transform Australian industries* [media release], Telstra website, 30 May 2023, accessed 12 September 2023.
[93] Department of State Development, Infrastructure, Local Government and Planning (DSDILGP), *How digital twins can help us plan a better Queensland*, DSDILGP, Queensland Government, 2022, accessed 12 September 2023.

Supply chain analysis: Retail, services and applications

Impact on telco networks

Australian telco providers are responding in a variety of ways to new customer demands and preferences. This response includes:

- evolving network configurations
- expanding services across industry verticals to diversify revenue
- partnering with hyperscalers to provide a range of cloud-based communication.

Evolving network configurations

Australian network configurations have evolved to allow greater flexibility and agility. Telcos are harnessing 5G to improve network performance and security, and reduce costs through functions such as open radio access network trials, network slicing, virtualisation, and SD-WAN. Telstra, for example, switches to wi-fi calling when the signal is stronger than its network signal and TPG offers SD-WAN to enterprise customers.

While these functions allow for better customer experience, other functions such as edge computing allows telcos to offer new products in the retail market. Edge computing with 5G connectivity enhances services such as digital payments, IoT platforms and cloud gaming, by allowing near real-time M2M communication and improved network security.

Service expansion to diversify revenue streams

As consumers shift towards new online services and applications, telcos have subsequently offered tailored data plans or entered the market with their own products. Examples include internet gaming optimiser plans, SVOD products (Telstra TV and Optus Sport), unmetered social media and audio streaming plans, new direct-to-mobile emergency communication services, online payment tools (Tyro's EFTPOS solution) and IoT platforms.

Partnerships with hyperscalers

Australian telcos have been partnering with global hyperscalers (Microsoft, Google and Amazon) to support a range of services and applications. For example, Telstra and Microsoft's new 5-year agreement allows the telco to leverage cloud infrastructure in return for access to end-to-end connectivity in Australia.[94]

Impact on the telco supply chain

Developments in services and apps in Australia have resulted in the following major impacts to upstream markets in the communications supply chain:

- network infrastructure and equipment upgrades
- increased production pressure on equipment manufacturers
- investment into cloud-based infrastructure
- investment into edge computing infrastructure.

[94] Microsoft, *Telstra and Microsoft sign five-year strategic agreement to support Australia's digital growth*, Microsoft website, 2022, accessed 12 September 2023.

Network infrastructure and equipment upgrades

There is demand for more consumer equipment, such as smartphones, wi-fi modems, gaming hardware and IoT sensors. This, in turn, is increasing the demand for chipsets from global equipment manufacturers. These manufacturers experienced chip shortages as a result of the COVID-19 pandemic. They are now redistributing their chipsets supply to enterprise customers:

- Telstra,[95] Optus[96] and TPG[97] have all announced further 5G rollouts in 2023 to radiocommunication infrastructure (towers or cells, sites, fibre links) and equipment (base stations, routers, antennas).
- Telstra and Vocus have made significant investments into their national fibre backhaul networks.[98]

Increased production pressure on equipment manufacturers

Equipment manufacturers are experiencing increasing pressure to produce higher volumes of consumer equipment such as smartphones, Wi-Fi modems, gaming hardware and IoT sensors.

This is a result of the lingering effect of chip shortages since the COVID-19 pandemic. However, manufacturers are now redistributing their chipsets supply to industrial enterprise customers:

- Technology firm, Meshed IoT, was awarded the contract to supply base stations and IoT sensor devices to various councils across central Victoria.[99]
- Chipset manufacturer, MediaTek, has expanded from making smartphones, smart TVs, IoT devices and networking products, to now making VR headsets in partnership with Sony.[100]
- Qualcomm partnered with Iridium to supply smartphone chipsets. These are used in mobile phones that allow direct-to-mobile satellite calls for emergencies in Australia.[101]

Investment into cloud-based infrastructure

Across Australia, hyperscalers are investing in cloud infrastructure. This includes CDNs, local caching, submarine cables and data centres. These investments enhance network capacities, reduce latency, and support the transfer of higher volumes of video content.

Content providers and network operators are also collaborating to establish submarine cables and peering arrangements to facilitate efficient content delivery:

- To support its Azure platform, Microsoft is building more data centres across Canberra, New South Wales and Victoria.[102] This includes establishing local CDN servers. These servers will run Xbox Cloud Gaming and ‘Power Platform and Dynamics 365 apps’ (these apps will support hybrid working and other digital needs of customers).[103]
- Telstra Broadcast Services launched an end-to-end video service ‘Web3 CDN’. This service provides high-quality 4K video at low latency for live and on-demand content.[104]
- Alphabet, Amazon Web Services, Telstra, Optus, TPG and Vocus have all invested in submarine cables connecting to Australia.[105]
- Pentanet and Optus have partnered with NVIDIA to offer its ‘’GeForce Now cloud gaming service.[106]

> Netflix has established peering interconnections with 5 local data centres in Melbourne and Sydney. This supports higher quality and faster delivery of content to Netflix's customers. It also reduces local network traffic.[107]

Investment into edge computing infrastructure

IoT platforms, cloud gaming and digital payment tools are driving the need for real-time data processing and secure transactions at a low latency. As edge computing allows for data processing and storage to occur closer to the devices and sensors, it reduces network latency, ensures data privacy and enhances security for such services. This is driving investment in edge compute infrastructure across Australia:

> Radian Arc provides edge infrastructure to telco networks. It has partnered with ActivePort to sell gaming services through local telcos.[108]

> A partnership between Cisco and Leading Edge Data Centres built 16 data centre sites across Victoria and Queensland in 2022. This supports local enterprises with a range of capabilities such as machine automation, asset tracking and telehealth.[109]

[95] Telstra, *Five years of 5G: How we built our world-leading network*, Telstra website, 2023, accessed 28 February 2023.
[96] Optus, Optus invests $5.3m into telecommunication upgrades in the Shoalhaven region [media release], Optus website, 4 April 2023, accessed 12 September 2023.
[97] TPG Telecom, *TPG Telecom Limited: 2022 Full-Year Results* [PDF], TPG Telecom website, 2023, accessed 12 September 2023, p. 28.
[98] ACMA, Communications supply chain market study: From equipment and spectrum to wholesale services.
[99] Meshed, *LoRaWAN IoT Case Study*, Meshed website, n.d., accessed 10 November 2022.
[100] S&P Global, *Chip designer MediaTek looking past metaverse to 'ambient era' of computing*, S&P Global website (subscription), 2023, accessed 3 May 2023.
[101] Qualcomm, *Qualcomm Introduces Snapdragon Satellite, The World's First Satellite-Based Solution Capable of Supporting Two-Way Messaging for Premium Smartphones and Beyond* [media release], Qualcomm website, 6 January 2023, accessed 12 September 2023.
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Glossary

Term	Definition
ABS	Australian Bureau of Statistics
ACCC	Australian Competition and Consumer Commission
ACMA	Australian Communications and Media Authority
Apps	Applications
AVOD	Advertising-supported video on demand. AVOD services include advertising with video content, which is generally accessed for free or at a lower price than subscription video on demand services.
BVOD	Broadcast video on demand. BVOD services are similar to AVOD (free ad-supported services), however content is generated from traditional television broadcasters.
CDN	Content delivery network. CDNs assist the delivery of content to end users. CDN servers are hosted by local networks, physically located in their data centres. The CDN speeds up internet caching by saving content closer to end users (nearest CDN server) rather than the creator's website, which could be overseas.
CPaaS	Communications platform as a service. CPaaS refers to a cloud-based service that provides real-time communications capabilities; voice, messaging, video and business applications.
EFTPOS	Electronic funds transfer at point of sale
Gbps	Gigabits per second
GSO	Type of satellite launched into geosynchronous orbit – operates at an altitude of approximately 36,000 km.
Hyperscalers	Global cloud service providers, which supply massive-scale cloud infrastructure as well as managed cloud or direct-to-customer cloud services.
IoT	Internet of things. Physical objects with sensors, processing ability, software and other technologies that connect and exchange data with other devices and systems over the internet or other communications networks.
LEO	Type of satellite that operates in low earth orbit between 160 km and 2,000 km above the Earth.

Term	Definition
M2M	Machine-to-machine communications
Mbps	Megabits per second
MNO	Mobile network operator – commonly associated with Australia's 3 largest operators: Telstra, Optus and TPG Telecom.
NBN Co	Australia's government-owned national wholesale broadband provider that operates the national broadband network.
OTT	Over-the-top service. OTT relies on local network connectivity and content delivery networks, to determine the closest server to transfer internet content internationally or domestically to a user, at the fastest speeds.
QR code	Quick response code. A QR code is a barcode that holds information horizontally and vertically.
RAN	Radio access network
SD-WAN	Software-defined wide area network
smallsat	Satellites that weigh less than 500 kilograms, also known as a small satellite.
SMB	Small and medium-sized business
SMS	Short messaging service
SVOD	Subscription video on demand. SVOD services offer subscribers access to a library of content that can be streamed on demand for a recurring fee.
TB	Terabyte (there is 1000 GB in 1 TB)
telco	Telecommunications service provider
TVOD	Transactional video-on-demand. TVOD services are online video rental services, where the consumer pays for access to content for a limited period or downloads it onto a local device.
VoIP	Voice over internet protocol. VoIP uses a wireless, cloud-based system that transmits voice digitally over the internet.
Wi-fi	Wireless fidelity – a type of radio communication that sends signals using radio waves from a router to nearby devices.