

Witness Statement

Re: Application for merger authorisation by Telstra Corporation Limited and TPG Telecom Limited for sharing of active infrastructure and spectrum in regional Australia

Singtel Optus Pty Ltd

Statement of: **Paul O'Sullivan**

Address: 1 Lyonpark Road, Macquarie Park, NSW 2113

Occupation: Company Director

Date: 19 October 2022

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Filed on behalf of Singtel Optus Pty Ltd

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I, Paul O'Sullivan, of 1 Lyonpark Road, Macquarie Park, NSW 2113 , say:

1. I hold several company directorships and have experience across industries including financial services and telecommunications. I am currently the Chairman of Singtel Optus Pty Limited (**Optus**) and am a member of the Optus Advisory Committee (**OAC**).
2. I am making statement in relation to the authorisation application lodged by Telstra Corporation Limited (**Telstra**) and TPG Telecom Limited (**TPG**) with the Australian Competition and Consumer Commission (**ACCC**) on 23 May 2022 for the sharing of both active infrastructure and spectrum in regional Australia (**Proposed Transaction**).
3. At the time of making this statement I have had exhibited to me a bundle of documents marked **Exhibit POS-1** and another marked **Confidential Exhibit POS-2**. The documents contained in these exhibits are true and correct copies of the documents that I have referred to in this witness statement.
4. The matters that I have set out in this statement are based on my knowledge, unless otherwise indicated, and are further true and correct to the best of my knowledge and belief.

1. Background

5. I have more than 25 years' experience in the telecommunications sector.
6. Optus is a wholly-owned subsidiary of Singapore Telecommunications Ltd (**Singtel**). I have held various leadership roles both within Optus as well as across the broader Singtel Group over the past 24 years.
7. From 1998 to 2001 I was Managing Director of Optus Mobile.
8. From June 2001 to September 2004 I was the Chief Operating Officer (**COO**) of Optus. In my role as COO, I oversaw all trading, networks and information technology activities across the Optus business.
9. In September 2004 I was appointed the Chief Executive Officer (**CEO**) of Optus and remained in that role until March 2012. In that role I led Optus' operations in Australia. As Optus CEO, I was also a member of the Singtel Management Committee (**MC**).
10. In March 2012 I was appointed CEO of Group Consumer at Singtel, a position I held until October 2014. As CEO of Group Consumer at Singtel I oversaw the consumer businesses across the Singtel Group, including operations in Singapore and Australia. I

also oversaw Singtel's international investments in various telecommunications providers including in India, Indonesia, Thailand and Philippines, as well as parts of Africa. During my time in this role, I continued to be a member of the MC, which considered investment decisions and capital expenditure across Singtel's various business divisions.

11. Throughout my career I have also held positions on a number of boards of associated telecommunications businesses in which Singtel has held, and continues to hold, financial interests. In particular:

(a) From 2003 to 2010 I was a Non-Executive Director on the Board of Bharti Airtel. Bharti Airtel is a leading organisation in the Indian telecommunications market.

(b) From 2010 to 2020 I was a member of the Board of Commissioners of Telkomsel. Telkomsel is the largest mobile communications company in Indonesia.

12. I am also a member of the OAC. [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED] I have also been a Director of Optus since September 2004 and Chairman since October 2014.

13. I hold a Bachelor of Economics from the Trinity College Dublin and am a graduate of the Advanced Management Program at Harvard Business School.

2. Singtel and Optus' operations in Australia

14. As I noted above, I have had a long professional association with Singtel and Optus. I was the Optus CEO for a period of almost 8 years from 2004 until 2012. I have also held a number of roles across the Singtel Group. This has provided me with considerable insights into the operations of the Singtel Group, including Singtel's oversight of its wholly-owned subsidiary in Australia.

15. I have had an ongoing association with Optus since my tenure as Optus CEO. In particular, I am also consulted about Optus' strategic direction as a member of the OAC. As Chairman of Optus I am aware of and consider the decisions taken in accordance with Optus and Singtel policies and governance framework. The Board typically meets

on a quarterly basis, unless a more frequent meeting is required, and I regularly engage with representatives of both Singtel and Optus management to keep informed.

A. Singtel investments and capital management

16. In my various roles at Optus and Singtel I have gained considerable insight into Optus' operations in Australia and Singtel's approach to managing investments across the Singtel Group. This includes Singtel's approach to decision making regarding capital investments across its interests, including where capital should best be directed.

17. [Redacted]

18. [Redacted]

19. [Redacted]

20. [REDACTED]

21. [REDACTED]

[REDACTED] S&P Global Ratings has charted the capex to revenue ratio of operators in the Asia Pacific which shows elevated ratios associated with 5G deployment, but which is forecast to fall back closer toward 15% in FY 23. This is shown in Chart 17 (pg 27) of S&P Global Ratings, *Industry Top Trends 2022*, which is at Tab 1 of Exhibit POS-1.

[REDACTED] For example, Telstra's capex to sales ratio was 13.4% in H1 2022 and 14.5% in FY2022. That is shown in Telstra's August 2022 Debt Investor Update (pg 16) at Tab 2 of Exhibit POS-1.

22. [REDACTED]

23. [REDACTED]

[Redacted text block]

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[Redacted text block]

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B. 5G business case and 5G rollout

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[REDACTED]

33. [REDACTED]

34. [REDACTED]

C. Infrastructure investment in the telecommunications sector

35. In the course of my roles at Optus I developed a detailed understanding of the business, including the technical operation of the network as well as the various competitive levers.

36. In my experience, mobile network operators compete with one another in a number of different ways, including in respect of price and the quality of service that they offer. However, [REDACTED] I regard coverage as particularly important. Infrastructure investment is therefore critical to competition between mobile network operators. For example, Telstra's extensive mobile network allows it to charge a price premium to its customers. The extent of infrastructure investment influences both the extent of network coverage that is available to customers, but also the speed and features available. That in turn impacts the extent to which customers are willing to pay for the service. Infrastructure investment is at the core of how mobile operators go about winning business. Any reduction in incentive for mobile networks to invest in network infrastructure will have a flow on effect in terms of service and price-based competition.

37. Telecommunications operators closely monitor their customers and competitors. This includes monitoring competitors in relation to geographic coverage, as well as the capabilities and features of their respective services. Operators will assess where they

may be able to rollout or augment their network to achieve a competitive advantage or, conversely, where a competitor may be winning customers due to their lack of service or patchy coverage which therefore needs to be rectified. In my experience there are numerous examples of industry change and technology cycles that illustrate the significance of infrastructure based competition. I set out below two examples in fixed line services where Optus' investment further drove Telstra to invest below.

(i) Broadband growth and DSLAM infrastructure

38. In the mid-2000s there was a significant trend in the fixed-line sector regarding the growth in internet services and, in particular, asymmetric digital subscriber line (**ADSL**) services. Under the regulatory framework at the time, telecommunications providers could acquire certain services from Telstra as access seekers (i.e. unconditional local loop or line sharing services). Those services could then be combined with the provider's own digital subscriber line access multiplexer (**DSLAM**), typically installed in the Telstra exchange, which then allowed the provider to offer broadband services.
39. In order for the telecommunications provider to be able to offer broadband services to customers, it required access to the Telstra exchange to instal DSLAM technology:
 - (a) DSLAM is a network device that allows multiple customers to be connected to the internet via a digital subscriber line (**DSL**). DSLAM uses 'multiplexing' technology to communicate high-calibre bandwidth between users. The benefit of DSLAM is that it allows multiple sets of data to be aggregated as a single, complex signal.
 - (b) DSLAM was often installed at the telephone exchange and connected to the primary internet backbone or router through a high speed network connection. When a DSL subscriber used the internet, data was transferred to and from the modem. DSLAM brought together data transfers from various users and passed those to the primary internet backbone or router, and then back to the individual modem. By doing that, DSLAM allowed greater volumes of users to have access to high-speed internet.
40. The combination of services acquired from Telstra and the installation of DSLAMs at Telstra exchanges was commonly referred to as 'quasi-infrastructure investment'.
41. I recall two particular issues that arose in the context of installing DSLAM technology that I regard as particularly relevant in relation to infrastructure based competition:

- (a) First, in around 2005 Optus announced a significant investment to install DSLAMs across a large number of Telstra exchanges. The effect of that installation program was to significantly extend the availability of certain higher bandwidth ADSL services (**ADSL2+**) on the Optus network. I recall that following Optus' announcement, Telstra announced similar plans to extend the reach of its ADSL2+ services. My recollection is that, at the time, Telstra primarily offered those higher bandwidth ADSL services in locations where other telecommunications providers had installed DSLAM technology and were offering those enhanced services.
- (b) Second, at around that time, access seekers like Optus were facing considerable challenges in gaining access (or timely access) to Telstra telephone exchanges in order to install DSLAM infrastructure. While broadband presented an opportunity for new entrants to establish their position in the Australian telecommunications sector, this was limited by the inherent advantage retained by Telstra through its ownership at the time of the copper local access network and its HFC network. Telstra's actions resulted in the ACCC making a record keeping rule in around July 2008 that required Telstra to provide reports to the ACCC about access to its exchanges.

42. The growth in higher bandwidth broadband services through the installation of DSLAM illustrates the need for infrastructure-based competition. Despite steps by Telstra to limit access, the persistence of smaller telecommunications providers accelerated the availability of higher bandwidth broadband than what otherwise would have occurred.

(ii) Rollout of the Optus HFC network

43. I consider that the events surrounding the rollout of Optus' hybrid fibre coaxial (**HFC**) network further illustrate the importance of infrastructure-based competition. While this occurred shortly prior to my appointment as Managing Director of Optus Mobile, they are events with which I am very familiar and which I regard as significant in Optus' history.
44. In early 1994, Telstra commenced construction of a HFC (cable) telecommunications network. Later in 1994, Optus, together with several joint venture partners, announced that it would also construct a HFC network. The Optus HFC network was intended to operate across the major Australian capital cities and would pass a significantly larger number of homes compared to Telstra's HFC network. Optus' business case relied on the network supplying pay television services. However, it would also supply telephony

and, later, high speed data services which would compete with Telstra's existing network.

- 45. In response, Telstra announced that it was significantly expanding the reach of its HFC network, that construction would occur rapidly and that there would be a significant degree of duplication between areas covered by the Telstra and Optus HFC networks. Optus and Telstra also competed fiercely to obtain rights to sports and media content.
- 46. The rapid expansion of the Telstra network, the degree of duplication of Optus' proposed network and the cost of securing premium content meant that Optus' business case no longer made sense. As a result, in 1997 Optus announced that it would significantly decrease the size of the planned network. In response, Telstra also reduced the size of its proposed HFC rollout. Both parties later wrote down the value of those assets.
- 47. The Committee for Information, Computer and Communications Policy at the Organisation for Economic Co-operation and Development (OECD) has published a paper which helpfully summarises the history and evolution of these matters (at pages 25-27). A copy of the OECD paper is included at **Tab 3 of Exhibit POS-1**.
- 48. I regard these events as further illustration of the significance of infrastructure based competition in delivering innovative telecommunications technologies to Australian consumers. [REDACTED]
[REDACTED]. Nevertheless, the events illustrate the value of infrastructure competition in rapidly delivering new technologies to end consumers.

2. Optus' response to the Proposed Transaction

49. [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
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50. [REDACTED]
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2. Network sharing

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60.

[Redacted text]

Signature of witness

[Redacted signature]

Paul O'Sullivan

S&P Global Ratings

Industry Top Trends 2022

Telecommunications

Telcos Are On The Hunt For Better Earnings And Returns On Investments



This report does not constitute a rating action

January 25, 2022

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What's changed?

Demand for high-speed broadband materializes, but without systematic monetization. Everywhere, customers are upgrading their fixed broadband plan, but benefits of these upgrades have been unequal from one region to another.

Regulatory bodies increasingly supporting infrastructure rollout. High-speed connectivity showed its importance during the pandemic, and we see regulators and governments increasingly supporting network rollouts and upgrades.

M&A appetite has increased in recent months. This has been mainly fueled by the monetization of tower and fiber assets, the expansion of the digital/tech segment, and the reorganization of media businesses.

What are the key assumptions for 2022?

Modestly rising revenue and earnings. We forecast modest revenue and earnings growth in 2022, driven by the gradual take-up of higher priced broadband and mobile plans, improving roaming revenue, and handset upgrades.

Elevated capital expenditure (capex) will support fiber rollout and 5G-related spending. We expect capex for the sector will remain high in 2022.

Telco deleveraging is taking time. High investments to support fiber and 5G rollout, IT spending, and modest revenues and earnings growth preclude a significant and sustained improvement in the industry's leverage.

What are the key risks around the baseline?

Delivering adequate returns remain a key risk. Competition, service commoditization, and pro-consumer regulation could preclude an adequate return on large investments. However, we see potential for more supportive policy, especially in the U.S. and Europe.

Fixed-broadband drives short-term modest revenue and earnings improvement, but substantial 5G-led growth remains elusive. Demand for fast fixed broadband services remains high, with customers increasingly upgrading their connections. 5G use cases are still nascent, in our view, and large revenue opportunities are likely a few years away.

Supply chain disruptions and cost input inflation could hurt margins and free cash flow. So far, the impact has been somewhat muted for telecom and cable providers.

Ratings trends and outlook

Global Telecommunications

Chart 1

Ratings distribution

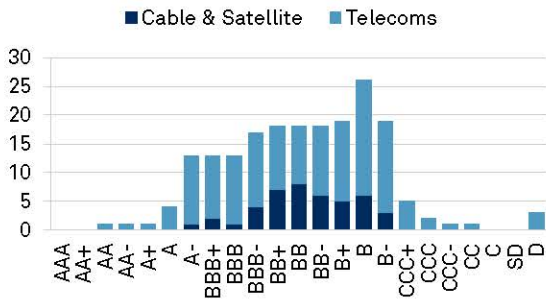


Chart 2

Ratings distribution by region

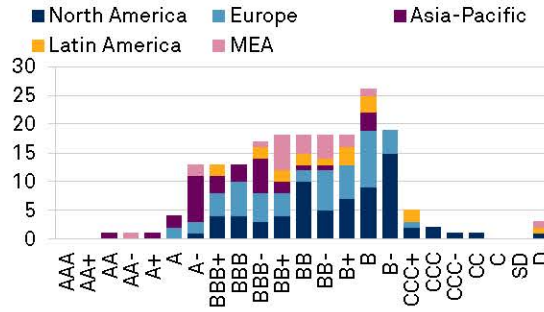


Chart 3

Ratings outlooks

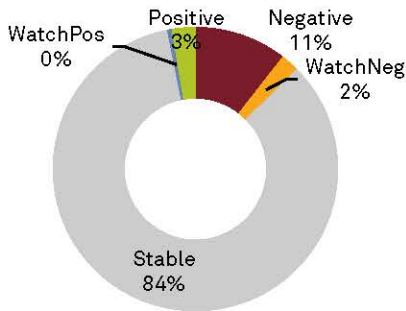


Chart 4

Ratings outlooks by region

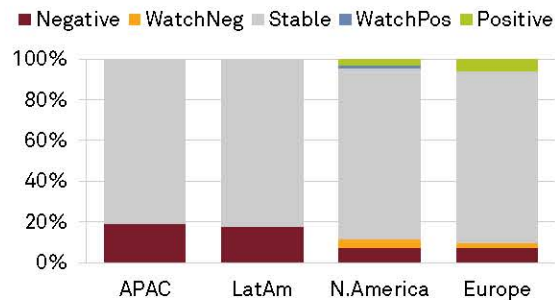


Chart 5

Ratings outlook net bias

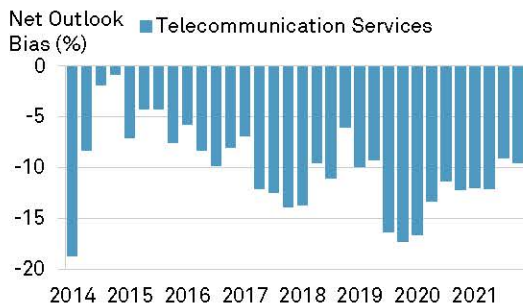
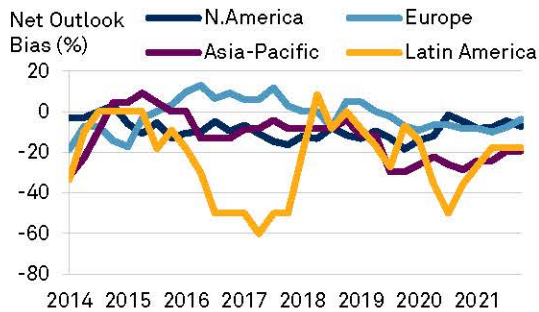


Chart 6

Ratings net outlook bias by region



Source: S&P Global Ratings. Ratings data measured at quarter end.

Global Telecoms

Ratings trends and outlook

Ratings in the telecommunications sector have outperformed our expectations when the pandemic started, and in recent months, the sector's credit profile has been relatively stable, with a slightly improving trend. Overall, 84% of telecom issuers have a stable outlook at year-end 2021, up from 79% in the previous year, and the proportion of companies with negative outlooks or CreditWatch placements improved to 13%, from 17% a year ago. In addition, the number of upgrades outpaced downgrades, led by positive rating actions in the U.S. Our net outlook bias improved to 9.4% negative at year-end 2021 compared with 12.1% negative a year earlier after we revised our outlooks on several issuers to stable from negative bias due to stronger-than-expected operating performance, or from positive outlook due to more aggressive financial policy or delayed integration of acquired companies. Also in this period, a few names having a negative outlook on ratings were eventually downgraded and then kept a stable outlook, which also contributed to the improvement of the rating bias. For 2022, we expect still-high leverage due to heavy investments in 5G and fiber densification, which could weigh on the industry's credit quality, especially if financial policies become more supportive of shareholder returns. Still, potential for industry consolidation and the adoption of digital processes coupled with growth from new services could be positive to credit. Regionally, credit quality is stabilizing everywhere.

Investment-grade issuers should fare well during 2022, because of generally stronger business attributes and greater financial flexibility. This comes despite having a relatively higher share of negative outlooks or CreditWatch listings than the overall portfolio, as of September 2021. In most cases, tight leverage headroom, a more aggressive financial policy, or a rating cap from the sovereign or parent company explained the higher negative bias. More than 85% of the speculative-grade portfolio has a stable outlook. However, SG issuers, particularly those with limited scale and differentiation, or companies indexed to legacy offerings or high investment needs amid weak balance sheets remain most vulnerable to negative actions in the coming year.

Main assumptions about 2022 and beyond

1. Growth will be uneven across regions

Emerging markets to benefit from stronger demand fundamentals, while growth in the U.S. and Europe will be curtailed by a highly competitive environment, as well as fading effects from economic reopening and stimulus checks.

2. Race for high-speed communications continues to escalate

We expect capex intensity for the sector will remain high in 2022, with telcos investing in next-generation networks, including fiber-to-the-home (FTTH) coverage expansion and 5G rollout, and scaling up IT and digitalization spending. Cablecos' capex intensity should be relatively stable, with U.S. cablecos increasing upstream speeds and capacity and European cablecos considering expanding footprints or upgrading to fiber technology.

3. Sizable funding needs for capex will pressure leverage metrics

High investments to support fiber and 5G rollout, IT spending, and spectrum auctions preclude a significant and sustained improvement in the industry's leverage.

Growth will be uneven across regions. The variance in growth rates we see features faster growth in Asia and Latin America, and low-single-digit growth in the U.S and Europe. In the U.S., we expect positive-but-slowing wireless service revenue growth upon increasing competition from the incumbent cable providers via their Mobile Virtual Network Operator agreements, and the fading benefits of economic reopening and stimulus checks introduced in 2021 that supported handset upgrades and migration toward higher-tiered rate data plans. Secular industry declines from legacy products, coupled with significant competition from cable broadband and lost subsidy revenue, will likely constrain wireline topline growth and profitability, and we expect a high-single-digit revenue decline in 2022. Cable subscriber growth should moderate from unsustainably high levels in the past two years, while competition from expanding FTTH will likely limit their market share gains. In Europe, we expect revenue growth will be modest, although up from 2021 levels as roaming and equipment sales continue to recover and because of the gradual benefit of accretive fixed-line broadband upgrades. Most telecom operators in APAC will maintain steady operating performance in 2022, supported by continued expansion in demand for data and customers increasingly selecting higher-priced data plans for their wireless and fixed broadband connections and despite delayed rebound in roaming revenues. In Latin America, growth factors will be higher access to postpaid plans and a better product mix with greater participation of mobile internet due to rising demand for data and 4G plans. Yet the growth trajectory could be curtailed by intense competition, where some operators still have a strong focus on protecting their market shares through more affordable offerings and highly competitive bundled packages.

The race for high-speed communications continues to escalate. While major fiber deployments will likely tail off within the next few years as household coverage increases, we expect 5G densification and investments in information and communication technologies (ICT) will limit a substantial drop in spending. The 5G spectrum auctions are finishing in North America--resulting in massive spending in the C-band and 3.5 GHz spectrum auctions--and Europe, and are ongoing in Latin America. Spectrum auctions affect telcos' cash flow in the near term though scheduled payments will continue to weigh on cash flow in the medium term. 5G is characterized by an extended buildout timeframe that will help moderate swings in capex intensity, but investments will be prolonged with no sharp curtailment as demonstrated by the most advanced Asian markets. High capex also somewhat reflects investment in ICT, including accrued digitalization and cloud-based services, as telcos look to diversify their offering from traditional voice and connectivity services to more integrated and valued-added digital services.

Sizable funding needs for capex will pressure leverage metrics. High capex and shareholder payouts will likely constrain discretionary free cash flow available for debt repayment in 2022, and largely offset modest revenue and earnings growth in 2022 for telecom providers. We believe telcos worldwide will continue considering alternate means to fund their capex, including network and spectrum sharing (some of which are arguably regulatory driven); the sale of noncore legacy, or lower-scaled telecom operations and media assets; and monetization of tower and fiber networks, providing some financial flexibility depending on the multiple and use of proceeds. Furthermore, government support to bridge the digital divide and support rural and remote broadband connectivity could allow servicing these areas to be more economically tenable for some providers. While we have a positive view of efforts to review strategy, capital allocation, and asset mix to mitigate rising financial risks and improve financial flexibility, tight leverage headroom will remain a key rating risk because the net benefit from such actions is limited from a credit perspective.

In 2020, many telcos revisited their shareholder remuneration policy in light of pandemic uncertainties. We expect 2021's normalization of shareholder return will continue in 2022, potentially exacerbated by pressure to increase shareholder return policies.

Credit metrics and financial policy

In 2022, we expect limited credit metric improvements and see risk for more shareholder-friendly financial policies.

Modest revenue growth and limited margin expansion, combined with incremental debt incurred to fund spectrum purchases, and spending to expand fiber and 5G networks will likely keep leverage elevated in 2022. Still, we expect leverage and liquidity management will remain key considerations for telcos as they continue to look for financial flexibility by, for instance, increasingly monetizing their assets or capturing growth opportunities through diversifying their ICT offering.

With the pandemic, prudent financial management--including lower return to shareholders and script dividends--was largely accepted as telcos were navigating through a recessionary environment with relatively tight leverage headroom and still elevated capex to maintain and extend their networks that proved to be key for the modern economy. We now believe that slow growth and weak stock prices could push many telcos to return more money to their shareholders, hampering any sharp improvement in the industry's leverage profile.

Key risks or opportunities around the baseline

1. Delivering adequate returns remain a key risk, although we see signs of more supportive regulation

Competition, service commoditization, and (so far) pro-consumer regulatory policies could preclude an adequate return on large investments. However, we see potential for more supportive regulation and policy, especially in the U.S. and Europe, because the pandemic has highlighted the value and strategic importance of well-invested networks.

2. Fixed-broadband drives short-term modest revenue and earnings improvement, but substantial 5G-led growth remains elusive

Demand for fast fixed broadband services remains high, with customers increasingly upgrading their connections. While potentially positive for operators, the realization of "more-for-more" revenue upside will vary, with more competitive markets unlikely to see material benefits. 5G use cases are in our view still nascent, and large revenue opportunities are likely a few years away.

3. Supply chain disruptions and cost input inflation could hurt margins and free cash flow

To date, the impact has been somewhat muted for telecom and cable providers. However, margins pressure remains a risk, mainly in the most competitive markets, and especially those without regular contractual pass-through mechanisms.

Delivering adequate returns remain a key risk, although we see signs of more supportive regulation. The industry continues to struggle improving its return on capital. Pro-consumer regulatory policies have helped shape the competitive dynamics in most jurisdictions over the past decade and have been a factor in our downgrades in recent years. Lower wholesale tariffs, network unbundling requirements, spectrum set-asides and caps, other support for new entrants to spur competition, and a limited appetite for consolidation have hindered incumbents from achieving greater returns on their investments. Indeed, the low return on capital across rated telcos has generally been declining, to less than 6% in 2021 from a bit more than 7% in 2011.

However, we believe pandemic-related lessons have the potential to slightly shift policies, to promote sustained network investments that support network resilience and

greater broadband access. This in turn could foster a more profitable and credit supportive environment. In Europe, countries like Spain and the U.K. have revised their wholesale fixed broadband rules mainly to promote fiber investments. Both the U.S. Congress and the European Commission have voted funds, of \$65 billion and €34 billion, respectively, to support broadband investments and consumer spending.

Finally, we believe regulatory objections to in-market consolidation could ease somewhat and lead to a more sustainable competitive environment. We have seen a few cases of in-market consolidation in some European and Asian countries since the pandemic's start. At the same time, we are cautious on potential benefits and will need to see a confirmation of this still-nascent trend. We do not believe a complete regulatory volte-face is probable as customer protection remains under the radar of governments and regulatory bodies. Regulatory direction is challenging to predict, and sector-wide consolidation could prove aspirational.

Fixed-broadband drives short-term modest revenue and earnings improvement, but substantial 5G-led growth remains elusive. Demand for fast fixed broadband services remains high, because the pandemic highlighted the importance of broadband to the modern economy. We expect adoption and usage of fixed-broadband services to remain strong as businesses embrace the benefits of remote work, and as consumer consumption of streaming services, e-commerce, e-learning, gaming, and social video use increases. Monetization of fixed broadband upgrades has been unequal between regions, meaning higher revenue growth in the U.S. than Europe or Latin America. We also believe that growth prospects will largely depend on the competitive and regulatory environment in a given market.

5G represents another area of long-term growth for the industry. We believe consumer 5G adoption will continue to gain momentum in 2022 as speeds and coverage improve, supported by recent spectrum auctions and network investments. Monetization is uneven between regions, with early adopters such as some markets in Asia-Pacific seeing a lift in average revenue per unit (ARPU) from 5G due to continued and steady upselling to larger and faster data speed plans, while gains are more muted in other regions like Europe. We believe carriers will need to be supported by industry and institutional participation in developing commercially viable use cases. We expect monetizable use cases to exploit 5G will take time to evolve and require additional investment, but could ultimately provide a new, and potentially substantial, source of sustainable cash flow. However, we forecast little revenue benefit until at least the latter half of the decade.

Supply chain disruptions and cost input inflation could hurt margins and free cash flow. High energy prices are a key risk, particularly in markets like Europe where spot prices have more than doubled. Margin pressure may become more prevalent in 2022, especially when contracts reset or hedges roll off. The risk will be particularly pronounced in more competitive markets and when there are no inflation-linked tariffs as higher prices could be difficult to pass on. Supply chain constraints will also remain under scrutiny in 2022 as they could affect fiber and 5G rollout, and pressure telcos' profitability, especially when combined with labor shortages. We believe long-lead time contracts and capacity to adjust capex plans could partly offset pressure from supply chain constraints, although persistent supply chain issues and wage inflation could lead to lower margins than we forecast.

North America

Ratings trends and outlook

In the U.S., upgrades outpaced downgrades in 2021 for the first time since 2014. While U.S. telecom and cable issuers were not hurt as much by the pandemic and recession as most corporate sectors, the rebound was also limited. Several factors drove upgrades, including better industry dynamics, especially for cable providers; stronger business conditions; and transactions that enabled debt repayment and leverage improvement. About 11% of telecom and cable issuers we rate either have negative rating outlooks or are on CreditWatch with negative implications, compared with 20% at year-end 2020 and 30% at year-end 2019.

In 2022, we expect rating trends among U.S. cable providers to be relatively stable despite the potential for moderating broadband subscriber growth and ongoing pay-TV customer declines. Although we expect high capital spending and aggressive competition could hurt credit quality for U.S. telcos, we believe that the current ratings already support these risks. Low interest rates and healthy capital markets could enable even low-rated issuers to refinance upcoming debt maturities, but the potential for rising interest rates because of the repricing of risk, inflation, and global supply chain challenges could pressure ratings.

Main assumptions about 2022 and beyond

1. Slowing customer growth in wireless and cable

We expect wireless competition to increase in 2022, resulting in slowing postpaid subscriber and service revenue growth. Similarly, fiber deployments could limit market share gains for cable, although there are still opportunities in non-fiber rural markets. However, migrations to higher-tiered rate plans in both wireless and cable will extend revenue growth.

2. Higher capex for telcos, although stable for cable

We expect a sharp increase in telco capital spending in 2022 because of ongoing FTTH deployments and the buildout of mid-band spectrum licenses.

3. FTTH development will pressure free cash flow and credit metrics for wireline operators

Recapitalizations and noncore asset sales have provided wireline operators greater financial flexibility to invest in fiber and compete with the incumbent cable providers. However, we expect lower free cash flow and higher leverage over the next couple of years.

Customer growth in wireless and cable slows. Rebounding from pandemic-driven weak operating performance in 2020, U.S. wireless operators posted their strongest subscriber gains and service revenue growth in several years during 2021. Conversely, U.S. cable providers experienced slowing broadband subscriber growth during the year as pandemic-related restrictions confined people to their homes in 2020, driving up the need for Internet connectivity.

We expect U.S. wireless service revenue to have increased 3.5%-4.0% in 2021, and slowing to around 2% in 2022 (see chart 7). Our forecast is based on the following assumptions:

Industry Top Trends 2022: Telecommunications

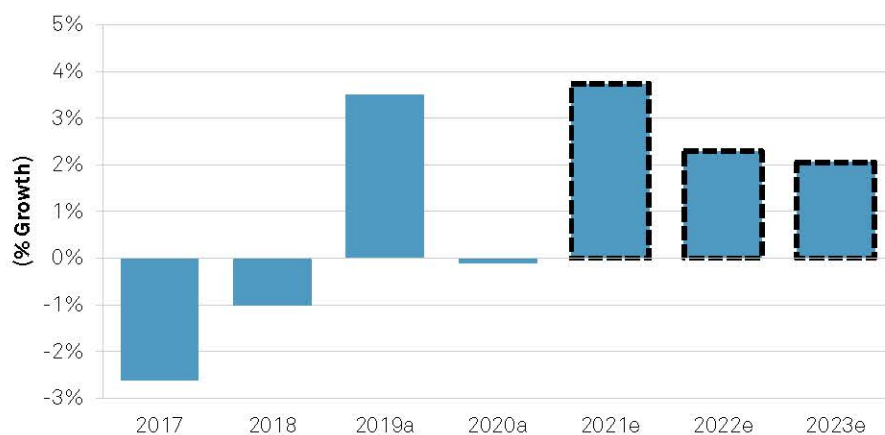
- The end of pandemic lockdowns helped increase store traffic and boost subscriber growth in 2021, which won't repeat in 2022.
- Stimulus payments allowed many consumers to upgrade handsets and migrate to higher-tier rate plans. The benefits of these will undoubtedly fade in 2022.
- Competition from cable is increasing, and industry conditions are mature. It is difficult to fathom that mobile phone subscribers will continue outpacing population growth and cable has taken about one-quarter of postpaid phone net subscriber additions each quarter over the past year.

Against the backdrop of slowing subscriber growth, we believe there are opportunities for the carriers as consumers upgrade to 5G handsets and migrate to higher-tiered rate plans. For example, Verizon stated that only 30% of its customer base was on premium unlimited plans but that two-thirds of new accounts were signing up for these, implying this migration will contribute to average revenue per account (ARPA) growth.

In Canada, we expect wireless service revenue to show low-mid single digit growth. We assume that roaming revenue to return to near pre-pandemic levels in second-half 2022 (only 50% in third-quarter 2021) and consumers will continue to migrate to higher-priced unlimited plans, offsetting slowdown in overage revenue. We also believe that lower wireless penetration (compared to the U.S. and Europe) and increased immigration in 2022 will continue to support wireless revenue. As Telus and BCE expand their FTTH and fixed wireless access to a large part of their footprint, we also expect growth in their wireline revenue in low-single digits, supported by the bundling opportunities.

Chart 7

U.S. Wireless Annual Service Revenue Growth Rate

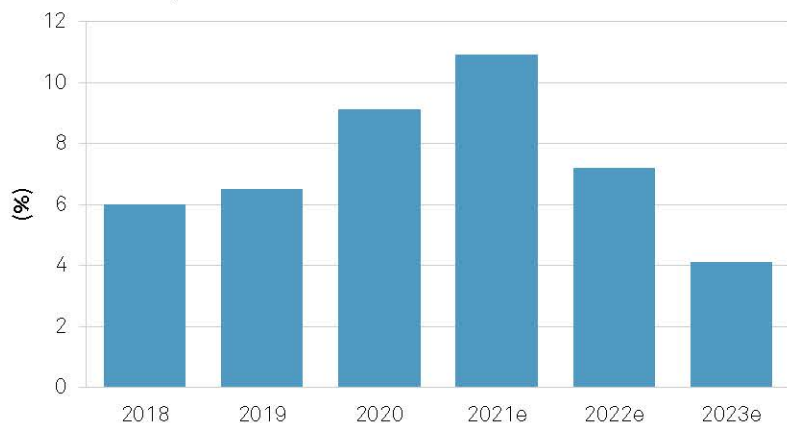


a—Actual. e—Estimate. Source: S&P Global Ratings.

We expect cable internet subscriber growth to moderate from unsustainably high levels over the past two years. We also expect that incremental competition from FTTH expansion and fixed wireless service offerings will gradually limit cable market share gains. However, assuming successful fiber deployments over the next five years, we project that just under 50% of U.S. households would still not have a service capable of delivering comparable internet speeds with cable (from about 70% today). We believe consumers in these rural markets represent a growth opportunity, particularly considering that cable has historically been underpenetrated in these markets due to a demographic that skews lower-income with lower-than-average data requirements. We believe a fundamental shift in consumer behavior toward faster, more reliable internet connections positions cable operators well in these markets. Therefore, we expect low-single-digit percent subscriber growth, and 3%-5% ARPU growth (as customers move to faster speed tiers) to support mid-single-digit EBITDA growth for the next two-to-three years (see chart 8).

Chart 8

Cable Industry EBITDA Growth



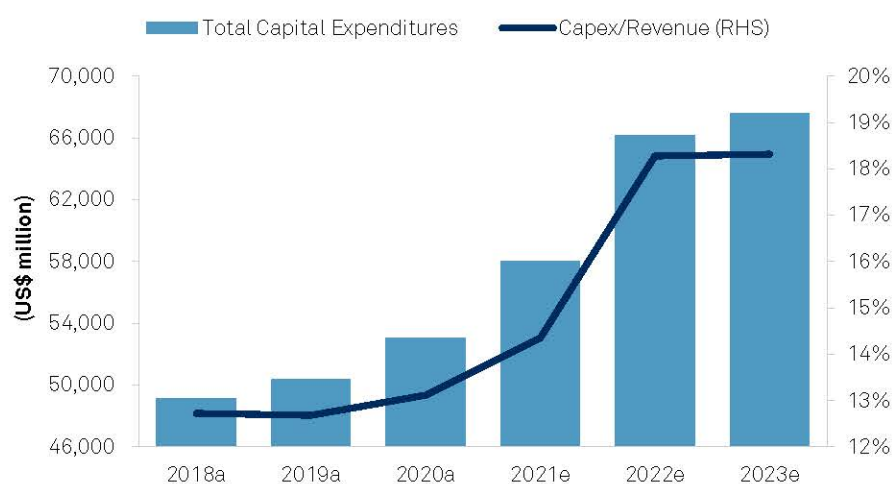
e—Estimate. Source: S&P Global Ratings.

Telcos have more capex, which is stable for cable. We expect U.S. telco capital spending to increase to 13%-15% in 2022 as carriers deploy spectrum licenses acquired in recent auctions and for FTTH builds (see chart 9). More notably, we expect increased spending to remain elevated over the next couple of years following the massive spending in the C-band auction as well as Auction 110, which was recently completed. We base our forecast on the following factors:

- Verizon plans to spend an incremental \$10 billion in capex to build out the C-band licenses from 2021-2023.
- AT&T plans to increase its capital spending by \$6 billion to \$24 billion in 2022, which will include FTTH deployments and spectrum builds.
- T-Mobile is continuing to build out its 2.5 GHz licenses acquired from Sprint.
- In addition to AT&T, U.S. wireline operators are all in the process of upgrading their networks with FTTH across their footprints.

Chart 9

U.S. Telco Capital Expenditures



a—Actual. e—Estimate. Source: S&P Global Ratings.

In contrast, cable industry capital intensity is likely to be stable, given its ability to incrementally scale networks affordably. We believe that cable’s most significant network investment over the next few years will be to increase upstream speeds and

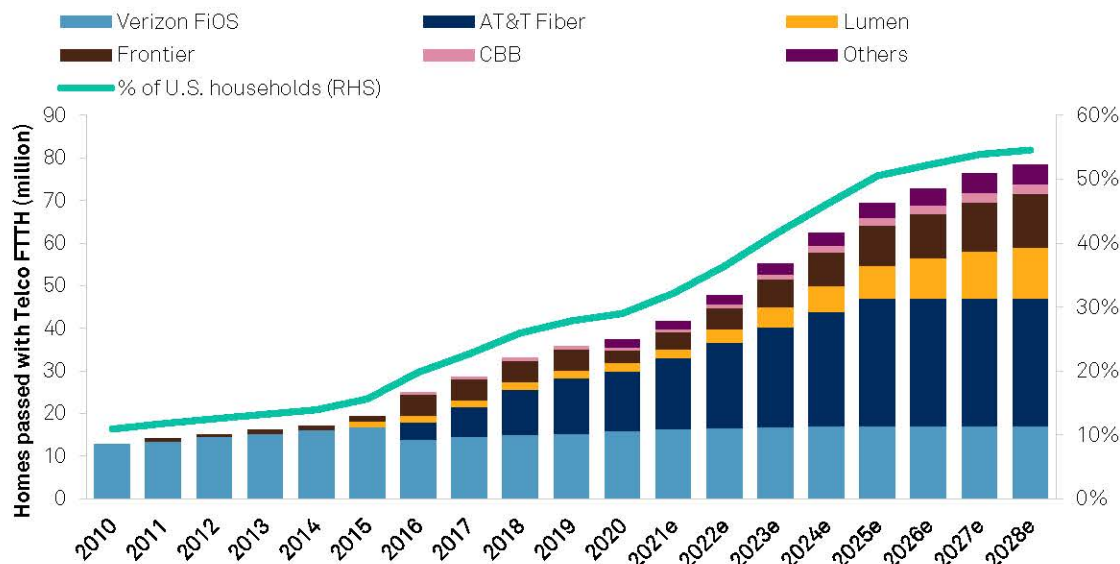
capacity. This can be accomplished by increasing the amount of spectrum dedicated to upstream, which requires changes to the active portions of the coax network (nodes and amplifiers) and potentially the passive portions of the network (splitters and taps). This mid-split or high-split activity, coupled with footprint edge-outs, is likely to increase costs moderately in the near term, offset by lower customer premise equipment costs as video customers decline.

FTTH development will pressure free cash flow and credit metrics for wireline operators.

Recapitalizations and noncore asset sales have given wireline operators greater financial flexibility to invest in FTTH broadband service to better compete with cable. And, if properly executed, investments in fiber should not only help stem the loss of broadband subscribers to cable, but also take share and grow ARPU. We estimate that U.S. telco FTTH coverage will be around 35% in 2022, up from 31% in 2021 (see chart 10). We expect FTTH to cover 50%-55% of U.S. households by 2028.

Chart 10

Telco FTTH Penetration In The U.S.



e—Estimate. Source: S&P Global Ratings.

Nevertheless, secular industry declines from legacy products--coupled with significant competition from cable broadband and lost CAF II subsidy revenue--could constrain top-line growth and profitability over the next several years. We forecast total U.S. wireline revenue will decline 5%-7% in 2022 due to lower revenue from legacy products, coupled with lost CAF II subsidy revenue. However, we expect topline declines to moderate in 2023 to 2%-4% as investments in fiber start to yield improving broadband trends. Still, solid execution during the buildout phase is critical and will ultimately determine if telcos can reduce leverage.

At the same time, high capex and costs associated with FTTH builds will likely hurt telcos' credit quality in the near term, although our ratings already largely reflect this. For 2022 and 2023, we expect wireline capex to increase to 10%-15% annually, reflecting the accelerated investments in fiber. While credit metrics are likely to deteriorate in the near term, the long-term benefits of FTTH deployments can be significant.

Similarly, Canadian telcos BCE and Telus accelerated their 2021-2022 capex plans by about C\$1.5 billion each to support their FTTH expansion. In addition, the significant spending on the 3.5 GHz spectrum auction in 2021, and the expectation of similar spending on C-band spectrum in 2023, will continue to pressure companies' cash flow.

However, with a majority of the FTTH expansion behind them in 2023, we expect pressure on cash flow measures to ameliorate.

Credit metrics and financial policy

Slowing subscriber and wireless service revenue growth, limited margin expansion, and incremental debt incurred to fund spectrum purchases and capital spending will likely keep leverage elevated in 2022 for U.S. mobile providers. And, the ability to monetize 5G investments will be challenging as most internet-of-things (IoT) and enterprise revenue opportunities are likely several years away, in our view. These factors are likely to contribute to limited credit metric improvement over the early phase of the 5G investment cycle following the spectrum purchased in the C-band auction, which pushed up leverage for all carriers. At the same time, slowing growth and weaker stock prices might lead large telcos to return more money to shareholders.

In U.S. wireline, secular industry declines from legacy products--coupled with lost CAF II subsidy revenue--could constrain topline growth over the next several years. At the same time, high capex and costs associated with FTTH builds will likely hurt telcos' credit quality in the near term, although our ratings already largely reflect this expectation. However, the long-term benefits of FTTH deployments can be significant. In addition to potential share gains, offering faster internet speeds should translate into higher ARPU that bolsters top-line performance. Solid execution during the buildout phase is critical and will ultimately determine if telcos can reduce leverage.

In U.S. cable, we expect EBITDA growth to moderate to 6%-8% in 2022 from above 10% in 2021 as competition gradually intensifies. This, coupled with relatively stable capital expenditures will likely translate to free operating cash flow growth of 6%-8% in 2022, which provides greater financial flexibility for most operators to manage their credit profiles. Therefore, cable operator's financial leverage improvement hinges largely on capital allocation decisions. We do not expect additional consolidation in the sector, as midsize players Cox Communications and Altice USA are unlikely sellers although management teams may pursue share buybacks in response to declining stock prices experienced in recent months.

Key risks or opportunities around the baseline

1. The new infrastructure bill could present opportunities for U.S. cable providers to extend broadband growth, but the regulatory environment is still uncertain

Congress recently passed a massive infrastructure bill, which includes an unprecedented \$65 billion to increase in-home broadband and affordability.

2. There are limited revenue opportunities and low investment returns from 5G mobile services

Massive spending in recent auctions have pushed up leverage, but revenue opportunities from 5G technology appear limited in the near term.

3. Ongoing supply chain disruptions and cost input inflation could hurt margins and free cash flow

To date, the impact of global supply chain challenges and cost input inflation have been somewhat muted for telecom and cable providers. However, we believe supply chain disruptions and inflation could yet pressure margins.

The new infrastructure bill could present opportunities for U.S. cable providers to extend broadband growth, but the regulatory environment is still uncertain. We believe cable operators are well positioned to benefit from funds that could come primarily in the form of subsidized buildouts into rural markets (\$40 billion) and consumer subsidies (\$14 billion). We believe cable operators have an opportunity to expand their footprint into markets that could not justify adequate stand-alone returns because of low population density or elevated construction costs. Absent more precise broadband maps (which the Federal Communications Commission [FCC] is updating), the exact number of homes that do not have access to high-speed internet is difficult to determine, but we estimate it is 12 million-15 million, or about 10% of the U.S. total.

This provides potential for cable operators to continue low-single-digit subscriber growth rates three-to-five years from now if they receive subsidies. We believe incumbent cable operators are well positioned to receive buildout subsidies compared with new entrants because extending their plant is more cost efficient. Money could begin to be allocated late in 2022, with service required within four years of the grant to the broadband provider. However, we recognize the process of data collection, broadband mapping, planning, and local coordination could be complicated and time-consuming.

Separately, the Democrat-controlled FCC is likely to reinstate Title II over the next year. We believe this will be used a way to enforce open internet concepts of no blocking, no throttling, and no paid-prioritization of internet traffic. However, it opens the door to pricing regulation, which could happen longer-term in some markets if prices and penetration continue to rise. However, we do not expect near-term price regulation considering that FCC Chairwoman Jessica Rosenworcel recently testified she does not intend to do so.

There are limited revenue opportunities and low investment returns from 5G mobile services. After spending \$95 billion for spectrum licenses in the C-band auction in March 2021, the wireless carriers followed up with another \$22.5 billion spent in Auction 110, highlighting the robust demand for midband spectrum. Spending in the C-band auction had a material impact on the balance sheets of wireless carriers. For Verizon, which spent \$53 billion in the auction, adjusted debt to EBITDA rose to around 3.2x from 2.5x, prompting S&P Global Ratings to revise its outlook to stable from positive while affirming its 'BBB+' issuer-credit rating on the company. Similarly, AT&T spent \$27 billion in the

auction, which pushed leverage to over 4.0x, modestly above our 3.75x downgrade threshold, from around 3.7x. However, the company announced in May 2021 that it would merge its media business WarnerMedia LLC with Discovery, for which it will receive about \$41.5 billion in proceeds. This transaction proved to be critical as it will enable AT&T to reduce leverage and invest in its telecommunication business.

In Auction 110, AT&T spent \$9.1 billion for 40 MHz of nationwide spectrum, the maximum that any company could spend in the auction and in line with our expectation of \$8 billion-\$10 billion. Its acquisition of licenses in the auction also enabled it to close the mid-band spectrum gap with Verizon and T-Mobile. Dish was the second largest winner in the auction, acquiring 31 MHz of nationwide spectrum for \$7.3 billion while T-Mobile only spent \$2.9 billion for about 12 MHz of nationwide spectrum, somewhat lower than our expectation for \$4 billion-\$6 billion.

In Canada, spectrum licenses in the 3.5 GHz auction sold for about US\$2.63 (C\$3.28 equivalent) per MHz-PoP average for the big 3 operators; this exceeded all previous valuations and was much higher than we have seen in other jurisdictions. Healthy bidding from incumbent players was a major factor, although interest from smaller players, including new entrants, was also stronger than we anticipated. As a result, debt leverage for the telecom sector continues to be elevated.

At the same time, the mobile carriers need to build out this spectrum, which typically results in higher levels of capital spending and lower free cash flow. And, the wireless industry is mature with limited growth opportunities in the traditional retail market. The ability to monetize these investments will be challenging as IoT opportunities are likely several years away, in our view. Both Verizon and T-Mobile are looking at 5G fixed wireless service as a potential revenue driver. However, while they might take some share at the lower-end of the market, we do not believe fixed wireless will be a meaningful threat to cable or FTTH broadband service. The technology is largely unproven and there are inherent reliability issues with wireless connections, which could frustrate consumers.

Ongoing supply chain disruptions and cost input inflation could hurt margins and free cash flow. To date, the impact of global supply chain challenges and cost input inflation have been somewhat muted for U.S. telecom and cable providers, in contrast to many other corporate sectors. Still, there have been pockets of stress and there is heightened risk in 2022 that these pressures could hurt margins and free cash flow, in our view.

For data center operators, energy is the largest component of the cost structure after rent. Higher prices are not easy to pass along and can only be re-priced when a contract comes up for renewal. Nevertheless, hedging strategies and some pass-through provisions can limit the impact on margins, although we believe that the negative impact of rising energy prices might be more prevalent in 2022.

There is also some evidence that supply chain issues are affecting FTTH deployments. AT&T lowered its guidance for 2021 FTTH passings to 2.5 million in 2021 from 3.0 million, although most telcos are constructive on their ability to manage the supply chain. However, we believe there is increasing risk that material and labor shortages could delay FTTH builds while pressuring margins because of higher input costs in 2022.

Europe and The Middle East

Ratings trends and outlook

In Europe, 85% of the rated portfolio is on stable outlook (compared with 77% a year ago), but in 2021 downgrades outpaced upgrades with four companies downgraded and only one upgraded (Hellenic Telecommunications Organization S.A. to 'BBB', in May 2021, after we took a similar action on the sovereign). Several factors drove downgrades, including operating underperformance compared to our base case (TalkTalk Telecom Group Ltd. to 'B' in December 2021 and Telecom Italia to 'BB' in November 2021), as well as inorganic drivers, including a leveraged buy-out (TalkTalk Telecom Group to 'B+' in January 2021 on the acquisition by Tosca IOM) and M&A (Lorca Telecom Bidco S.A.U. to 'B' after acquiring Euskaltel). However, ratings pressure is stabilizing with the number of negative outlooks and CreditWatch placements moderating to 10% of our ratings at year-end 2021, versus 17% a year ago. Assuming continued economic recovery supports further, if modest, revenue growth, and slightly lower capex translate into minimal deleveraging from the peak reached in 2021, we expect relatively stable European telecom ratings in 2022.

In the Gulf Cooperation Council (GCC) region, telecom operators ratings were unaffected throughout the pandemic in 2020 and currently remain on stable outlook. We recently revised our outlook on Bahrain Telecommunications Co. BSC (B+/Stable/B) to stable from negative following a similar rating action on the sovereign rating of Bahrain.

Main assumptions about 2022 and beyond

1. Revenue will increase modestly in 2022

European operators have weathered the pandemic, benefiting from business and consumer reliance on critical infrastructure driven by increased virtualization. However, they have been unable to translate high data consumption into sharp revenue growth, and we expect only modest increases, averaging about 2% through 2022.

2. Capex intensity could start declining, but will remain high

We believe average capex intensity will remain elevated, at 20.5%-21% of revenue, but will start declining from the peak reached in 2021 (21.2%) when telcos were catching up on fiber and 5G spending that was somewhat delayed because of the pandemic. Fiber rollout and 5G spending will continue fueling investments requirements in 2022.

3. In relatively stagnant conditions, what are the sector levers?

We think tower asset sales will continue and a growing number of operators will consider fixed-network sales. These transactions can strengthen balance sheets and provide financial flexibility, although proceeds and the deconsolidation of capex can be offset by our adjustments, limiting deleveraging prospects. 5G will shape operators' near-term investments strategy, while medium-to-long-term business use cases are still to be defined. Telcos are increasingly strengthening their digital offering as a way to diversify from more traditional voice and connectivity services and better monetize 5G-related use cases.

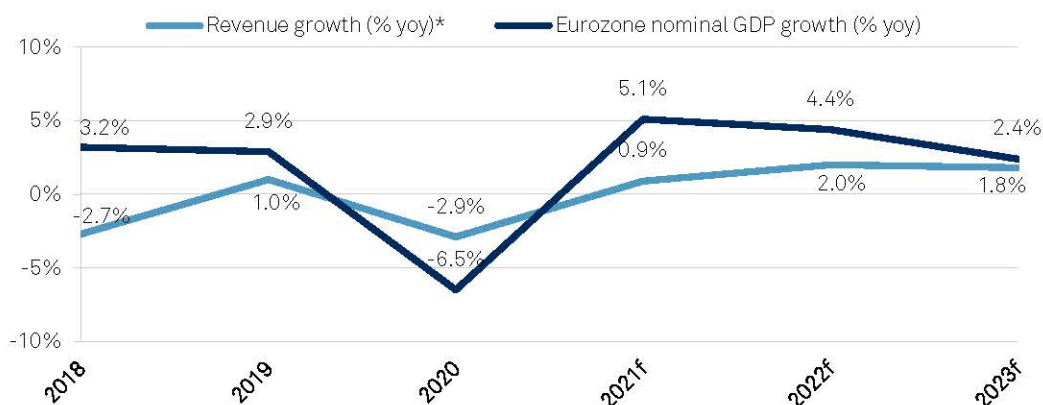
Revenue will increase modestly in 2022. European operators have weathered the pandemic headwinds, benefiting from business and consumer reliance on critical infrastructure driven by increased virtualization. Despite weaker equipment, roaming and business-to-business (B2B) performance in 2020, revenue declines were moderate at

about 3% for European telcos and cable operators in 2020. The sector outperformed the eurozone nominal GDP contraction of 5.0%. While reflecting the relative resilience of the industry to economic shocks and robust demand for connectivity during the pandemic, from fixed broadband consumers with high data consumption in particular, the contraction nonetheless illustrated the difficulty of operators to translate high data consumption into revenue.

In 2021, with the economic recovery and ease of lockdowns and other restrictions, the sector should return to low-level growth. We expect the trend will continue in 2022 with modest-but-improving revenue growth of about 2.0% from about 1% in 2021 for both European telcos and cablecos (see chart 11). Continued recovery in low-margin equipment sales thanks to pent-up demand and newly released 5G devices, gradual letup of pressure on roaming revenue, lower level of promotions, and gradual benefit of accretive fixed line broadband upgrades should fuel the expected revenue growth.

Chart 11

Modest But Accelerating Revenue Growth For European Telcos And Cablecos In 2022



*Revenue growth based on local currency revenues. f—Forecast. Source: S&P Global Ratings.

Over the first nine months of 2021, GCC telecom operators demonstrated revenue growth in the range of 2%-8% capitalizing on their leading market positions domestically and internationally. Improving economic conditions in the region, along with population growth following the contraction in expat numbers in 2020 and additional upside from the pick-up in international travel (particularly for the United Arab Emirates [UAE]) will drive 2%-3% revenue growth in 2022-2023. We think that data, digital, fixed broadband and non-telecom services, as well as roaming to a smaller extent, will support revenue growth. We also expect that operators will sustain stable profitability supported by ongoing cost efficiencies, as well as continued focus on more profitable postpaid offers. Etisalat (AA-/Stable/A-1+) and Saudi Telecom Co. (STC) (A-/Stable/A-2) have consistently demonstrated above-average profitability (S&P Global Ratings-adjusted EBITDA margin above 40%), backed by highly profitable domestic operations, and international operations in the case of Etisalat. The operators we rate all offer nationwide 5G coverage in their respective domestic markets.

Capex intensity could start declining, but will remain high. Capex to sales is likely to remain at 20.5%-21.0% in 2022, down modestly from the peak of 21.0%-21.5% in 2021 due to accelerated fiber deployments as the pandemic drove investment in high-speed connectivity and a catch-up in 5G spending after COVID-19 disruptions in 2020 (see chart 12).

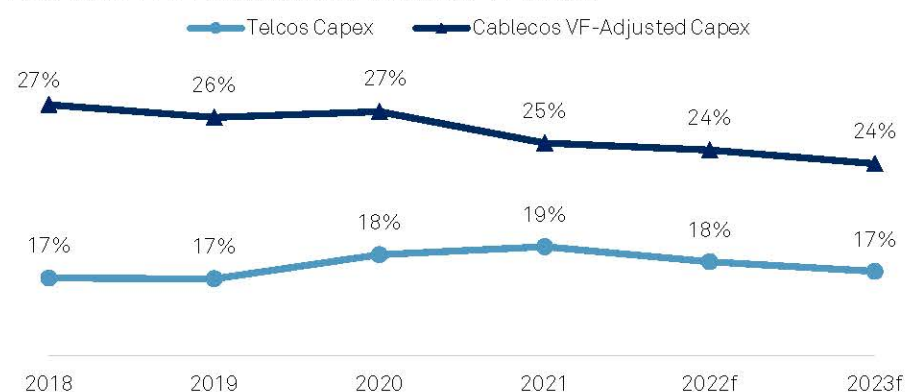
We expect the trend in fixed network upgrades will continue in 2022, bolstered by demand from customers and governments' plans to prioritize high-speed broadband development. This should be most pronounced in markets where fiber coverage is low,

such as Germany (about 22% of households) or the U.K. (about 25%). However, we forecast a slight decline in capex intensity because some European countries are more advanced in terms of fiber coverage--for instance, Spain (about 90%) or France (about 79%). While cablecos' network upgrades (including DOCSIS 3.1) approach completion, some of them are considering expanding footprints or upgrading to fiber technology, in contrast with many of their U.S. peers, which could maintain elevated capex intensity over the outlook period.

For mobile, while initial 5G spectrum auctions are largely completed in Europe, most deployment has been in the low and mid bands. With 5G handset penetration and subscriptions growing but still a minority of the installed base, and with higher frequency millimeter-wave rollouts requiring further network densification, we expect 5G spending will be relatively gradual and more long-lived compared with the rapid 4G rollout a decade ago. This, combined with ongoing fixed network upgrades, will likely keep capex intensity in the mid-to-upper-teen percent of revenue beyond 2022.

Chart 12

European Telecoms Average Capex (% Of Sales)



f—Forecast. Source: S&P Global Ratings.

While fiber and 5G rollouts might increase customer upgrade prospects, we do not forecast material upside. To date, the benefit of fixed broadband upgrades hasn't been to the same degree as in the U.S. market, largely because of the much more favorable competitive dynamics for U.S. cable providers. We also see weak short-term prospects for a 5G premium. Nevertheless, our forecast for incremental revenue growth, combined with largely stable absolute capex, should translate into modest cash flow improvement and slightly lower leverage estimated at 3.8x by year-end 2022, from 3.9x a year ago.

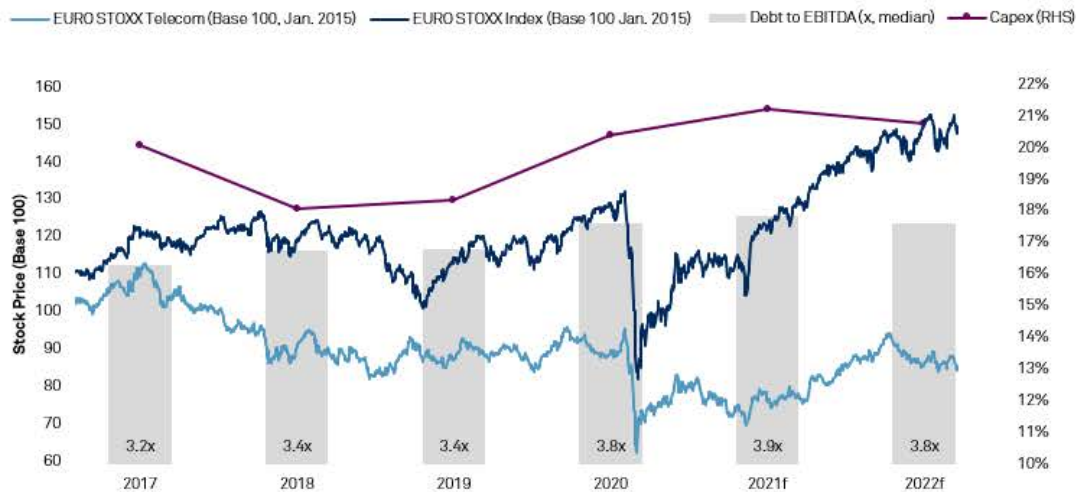
In the GCC region, we expect that capex will remain high, at about 18% of revenue on average in 2021 as operators continue to expand 5G coverage, as well as further invest in network upgrades in their international subsidiaries. Capex should gradually reduce in 2022-2023 to 14%-17% of revenue, as the network upgrades and 5G investments are well advanced with a coverage of 90% or more of populated areas in the UAE, Qatar, and Bahrain. However, since telecom operators are often enlisted by GCC governments to invest in infrastructure projects as part of economic development programs, we think that investment is unlikely to dip any further.

In relatively stagnant conditions, what are the sector levers? Operators are confronting a dilemma wherein their services and assets have never been more in demand by customers and important to society at large, yet there seems to be little evidence of this in operational and stock performance. With market competition unabated and persistently high capex requirements, we expect minimal growth prospects for traditional activities and adjusted debt to EBITDA to remain above 3.5x combined, all amid stubbornly weak stock performance (see chart 13). European telecom operators are therefore looking for growth levers and deleveraging strategies. The primary options we

see operators exploring include asset sales, 5G monetization, and increased digitalization.

Chart 13

Shareholder Pressure Could Mount After Weak Equity Performance But Telcos May Have Little Balance Sheet And Cash Flexibility



f—Forecast. Source: S&P Global Ratings.

Operators looking for ways to unlock the value of their infrastructure assets, starting with the sale of tower assets to help mitigate the industry’s challenges. While the sale of these assets have been going on for some years now, 2021 has seen the closing of transactions with very high EBITDA multiples, including the sale in January 2021 of Telefonica’s tower subsidiary, Telxius, to American Tower Co. at a record-high 30.5x EBITDA multiple, and the IPO of Vantage Tower in March 2021 at a 22x EBITDA multiple. Cyfrowy Polsat has taken an additional step, selling to Cellnex Telecom not only its passive infrastructure, but also its active equipment, which is traditionally retained and managed by the telecom operator.

Operators in the GCC region also rode the wave of asset monetization and we expect they will continue to do so. Some recent transactions include the listing of a 20% stake in solutions by STC in September 2021 which allowed it to raise \$1 billion. Indosat Ooredoo, Ooredoo Q.P.S.C.’s (A-/Stable/A-2) Indonesian subsidiary also disposed of towers for a consideration of \$750 million in 2021.

We believe the sale of tower assets will remain a popular arbitrage in 2022. Operators with large tower portfolios like Orange (which created a separate tower unit subsidiary) or Deutsche Telekom (which announced its openness to finding an industrial partner for deconsolidating its tower assets) could follow suit, and independent tower operators are increasingly eyeing Northern and Eastern Europe to continue their growth. High valuation multiples can still strengthen balance sheets and provide financial flexibility. However, sale and lease back adjustments create debt-like obligations that can partly or largely offset proceeds. In addition to the financial impact on credit, we also consider whether the sale could negatively affect operators’ business profile by materially reducing their competitive differentiation. However, mobile differentiation occurs across multiple factors, including spectrum holdings and active equipment, so this has generally not been the case to date.

More recently, fixed-lined infrastructure, and fiber in particular, has joined this trend. Offloading capex can be especially compelling for telcos early in the fiber investment cycle, or for those that are looking to extend coverage to less dense areas with high connection costs per household. Fiber sales--generally at lower multiples than towers'--

can deconsolidate debt-funded capex and reduce leverage pressure. Still, whether the strategic importance of the assets, and our view of the permanence of the deconsolidation are key considerations for us to follow the deconsolidation approach or, to the contrary, reconsolidate earnings, capex and debt into telcos' balance sheet potentially limiting deleveraging benefits from proceeds (see table 1).

Table 1

Joint Venture Treatment

Company Accounting	Company/Network	Asset Maturity	Ownership	S&P Approach
Deconsolidation	TEF Germany, Chile and Brazil JVs	Greenfield	50%	Deconsolidate
	Iliad	Largely Greenfield	49%	Pro rata
	Bouygues Fiber JVs	Largely Greenfield	49%	Pro rata
	Altice France	Largely Greenfield	50.01%	Pro rata
	Proximus Fiber JVs	Greenfield	50%	Pro rata
	KPN Fiber JV	Largely Greenfield	50%	Deconsolidate
Consolidation	Altice Portugal	Completed	50.01%	Pro rata

Source: S&P Global Ratings.

The industry has high long-term hopes for 5G opportunities, but we see only modest prospects in the short-term, with much of the cost front-loaded:

- Large spectrum outlays: 5G frequency auctions are finishing in Europe, though scheduled payments will continue to weigh on cash flows.
- High network capex: The extended buildout timeframe for 5G will help moderate swings in capex intensity, but it will be prolonged and with no sharp curtailment.
- Weak short-term monetization prospects for traditional connectivity.

We are particularly bearish on short-term revenue upside given Europe's competitively priced markets and the marginal 5G enhancement for today's most common mobile use-cases: traditional communication and apps, streaming, and social media. For instance, in France, Orange, Bouygues Telecom, and SFR launched 5G mobile plan with enriched data plans at a premium (€2-€5 per month), but Free upgraded its commercial plans to 5G at no extra cost.

In the medium-to-long term, we expect additional revenue potential, but mature and compelling use cases are still nascent. We expect the principal growth driver will be from new subscriptions, primarily machine-to-machine (M2M), to support new use cases requiring the unique attributes of 5G.

As 5G matures, the ability of operators in Europe (as in other regions) to move beyond connectivity and tap into the value added by new use cases is uncertain. To participate in the value created by autonomous driving and smart cities, or more specialized applications like remote medical procedures and augmented reality, operators will have to move from being connectivity providers to suppliers of more comprehensive IoT-based services.

Many operators are therefore diversifying--mainly through partnership or M&A--from more traditional voice and connectivity services to value-added digital services covering a wide range of IT-related, cyber security, IoT, or cloud-based services. This strategy also seeks to find alternative paths for growth while traditional services are becoming more and more utility-like. For instance, Telefonica created in 2019 Telefonica Tech, a subsidiary seeking to capture the growth of the digital services market to enrich its B2B offering. As part of its 2025 ambitions, Orange will also focus on accelerating IT service development for B2B customers while scaling up cybersecurity.

In the GCC region, we also think that the companies will continue to expand non-telecom businesses in pursuit of growth opportunities, including fintech, high-tech, cyber and

data. In 2021, STC subsidiary stc pay was granted a digital bank license, after the parent sold a 15% stake in the company to Western Union in 2020.

Credit metrics and financial policy

Our forecast for modest revenue growth, combined with continued cost-saving efforts, should translate into modest deleveraging from the 2021 peak, with adjusted debt to EBITDA at about 3.8x in 2022, from 3.9x in 2021. This is also supported by slightly more benign capex intensity that should improve cash flow. We believe selective asset monetization can enhance financial flexibility, although it depends on the use of proceeds and our adjustments for leases or minority ownerships.

Dividend cuts and script dividends have been largely accepted so far, but we believe rising demand for shareholder returns and private equity interests could pressure policies. The offer of KKR for Telecom Italia is an example of this interest, while asset monetization or M&A could increase return for shareholders depending on the allocation of proceeds.

In the GCC region, dividend distributions will remain sizable, balanced by moderate leverage at well below 2x on average. Etisalat and STC sustain ample headroom under the ratings given the companies' minimal leverage, which leaves leeway for external growth initiatives. In 2021, Etisalat increased its stake in Maroc Telecom by 4.6% to 53% in a United Arab Emirates dirham 1.9 billion debt-funded transaction.

Key risks or opportunities around the baseline

1. Regulation--there is potential for more supportive policy

We believe regulation on wholesale activities and in-market consolidation could become less constraining as COVID-19 has highlighted the value of well invested networks.

2. Customer protection remains a key focus in many markets

Customer protection will remain a key focus with several markets opening to a fourth player and the approval of stimulus spending that could also boost consumer spending.

3. Ongoing supply chain disruptions and cost input inflation could hurt margins and free cash flow

The impact of global supply chain challenges and cost input inflation have been somewhat muted for telecom and cable providers. However, supply chain disruptions and inflation could still further pressure margins, especially in the most competitive markets and absent any pass-through mechanism.

There is potential for more supportive regulatory policy. As operators continue to struggle with minimal growth prospects and uncertain returns on capex, we think more supportive regulation could be catalyzed by the pandemic, which has highlighted the value and strategic importance of well-invested networks in the eyes of many stakeholders. Given the societal benefits, government and regulators may rebalance priorities toward stronger support of network investments, and therefore be willing to pursue more supportive frameworks. For example, we expect more relaxed wholesale regulation could support an acceleration in next-generation fixed broadband investment. So far, many incumbents may have dragged their feet on fiber deployment because they were concerned over being forced to provide access to competitors. In this context, in 2021, the Spanish regulator updated the country's wholesale fixed broadband rules in an attempt to promote investments. It decided to significantly increase the number of cities deemed "competitive" to 696 (accounting for 70% of the Spanish population) from 66 (35%), which means incumbent Telefonica is no longer required to provide wholesale

access to its fiber network in these areas. In March 2021, the U.K. regulator, Ofcom, announced new guidelines for the country wholesale telecom market with the objective to foster fiber investments and support the shutdown of the copper network.

Both the European Commission and national governments aim at fostering broadband uptake. We estimate about €34 billion of direct and indirect broadband support from the European Commission, or about €5.7 billion per year over 2021-2026, and over €24 billion of additional direct broadband support from national governments (including the U.K.), or €4.8 billion per year over 2021-2025. We therefore estimate total annual contribution of about €10.5 billion per year over 2021-2025, which is just at or below 12% of total annual forecast capex for European rated telcos and cablecos. These funds are still in their infancy and are likely to be spread across a variety of programs, including supply side loans and grants to support investments, demand side customer subsidies, and indirect support to other stakeholders in the wider broadband ecosystem. Neither we nor issuers are likely to incorporate into capex or revenue assumptions until funding is more explicitly allocated or disbursed.

Qualitatively, on the supply side, we believe these funds could subsidize and boost network investment. In the U.K. for instance super tax deduction on qualifying investment means that BT expect to pay no U.K. tax in its current financial year ending March 31, 2022, and in its next financial year. This is a total tax saving of £0.6 billion-£0.8 billion, or £0.3 billion-£0.4 billion per year, 7%-9% of BT's adjusted capex. This supported its decision in May 2021 to accelerate FTTP rollout by an additional 5 million premises by 2026.

On the demand side, funding aims at supporting customer demand by encouraging new connections and upgrades. For instance, Italy benefits from broadband voucher programs to help low-income families access high-speed broadband services, to reduce the digital divide without influencing competition.

We could also see increasing tolerance for M&A and in-market consolidation, which could drive long-term benefits to market structure and create a more sustainable competitive environment. In 2021, several in-market deals were announced or closed, including the acquisition of regional cable and telecom provider Euskaltel by Masmovil in Spain, the takeover of MVNOs Euro Information Telecom and Coriolis by Bouygues Telecom and SFR, respectively, in France, and the closing in mid-2021 of the joint venture between Virgin Media and O2 in the U.K. We believe the trend could continue, starting with the potential combination of Telecom Italia's fixed asset unit FiberCop with national wholesale broadband player Open Fiber to create a national wholesale broadband player in Italy, and the merger between mobile operator Orange Belgium with cable operator Voo if approved by the European Commission.

Customer protection remains a key focus in many markets. We don't believe a complete regulatory volte-face is in the cards. Customer protection remains a priority as recently reminded by the U.K. competition watchdog announcing that Cellnex's proposed acquisition of CK Hutchison's towers in the U.K would harm competition by preventing the emergence of a third national tower player, translating into higher prices or worse terms for mobile operators and their customers. While not a direct verdict on the core mobile operator market structure, the decision indicates that customer protection and enhanced competition will remain a key regulatory and governmental focus, especially in some countries that are taking advantage of 5G-spectrum auctions to open the market to a fourth player like in Portugal or Belgium, for instance.

Ongoing supply chain disruptions and cost input inflation could hurt margins and free cash flow. To date, the impact of global supply chain challenges and cost input inflation have been somewhat muted for European telecom and cable providers. However, supply chain disruptions and inflation could yet pressure margins, especially in the most competitive markets and absent any pass-through mechanism.

Labor (accounting for about 25% of total costs) and energy (5%-10%) pose the most relevant inflation risk for telco margins (see table 2).

- So far, the impact from the labor market has been muted, and we view inflation pressure as a greater near-term risk in the U.S. However, persistent inflationary pressure could push wages higher, presenting a challenge to the cost-cutting and margin growth strategies of many operators.
- Energy price increases are already a reality across Europe, and may have a tangible effect on margins, particularly as contracts reset or hedges roll off. In Spain, Telefonica earnings were affected by higher energy costs over the first nine months of 2021 because there are no inflation-linked retail tariffs in the country, and despite some mitigants including promotion of more-for-more, pass-through mechanisms in most wholesale contracts, and cost efficiency measures. On the contrary, in the U.K., we expect inflation-linked price increases will support profitability and act as a hedge against inflationary pressures for operators like Vodafone, BT and Virgin/O2.

Table 2

Three Main Areas Of Concern For The European Telecom Industry

Margins		Capex
Labor (~25% of total cost) Labor inflation muted in Europe (so far)	Energy (5-10% of total cost) Price hedges can mitigate in short-term	Material & Equipment Possible delays or scale downs

Source: S&P Global Ratings.

Capex inflationary risk is mainly driven by supply chain bottlenecks creating scarcity for material and equipment. However, operators are only partly exposed. Long lead-time contracts can smooth the impact from transitory inflationary pressure. We also believe telcos have the option to delay or scale down their spending as they did in 2020 to protect their cash flow and absorb negative impact on their operations from the pandemic. Furthermore, material and equipment is only a portion of capex budgets, with the majority still linked to labor and construction, as well as software elements subject to less inflation risk.

Latin America

Ratings trends and outlook

Latin America issuers have significantly improved their negative rating bias to about 17% from close to 35% a year ago. The issuers with this negative rating bias are mostly in the speculative-grade category, which represent close to 80% of our rated portfolio.

Conversely, most IG issuers maintain a stable outlook not only based on their ability to cope with a difficult business environment over the past two years, but more importantly because their healthy balance sheets provide flexibility to absorb a gradual ramp-up in capital investments in the months to come. Overall, issuers with stable outlooks account for 82% of the portfolio, compared to 64% a year ago. This means we don't anticipate many rating actions, at least on a stand-alone basis. Nonetheless, some issuers face sovereign caps, or their creditworthiness correlates to some extent with the rating of a stronger parent company. We've identified some cases where majority shareholders would be seeking to divest certain operations, which could point to a lower commitment of extraordinary support, potentially diminishing the credit quality of some carriers. In Argentina, credit quality for the sector is weighted by tighter central bank regulations on accessing foreign exchange.

Main assumptions about 2022 and beyond

1. Limited upside on profitability due to intense competition

The race for market share is resulting in greater downside pressures on top line growth and margins.

2. Increasing capex to accelerate 5G deployment and network improvements

We now expect increasing multi-annual capital investments programs for network enhancements and technological upgrades.

3. Limited regulatory activity providing certainty on short-term industry dynamics

Existing legislation remains a key factor in the orderly growth of the telecom industry in 2022, as it provides certainty to sector participants.

Intense competition means limited upside to profitability. Telcos in the region performed better-than-expected throughout the pandemic, but the sector's revenue and margins have not escaped the very intense competition. Some carriers have emphasized their focus on market share through the launch of more affordable offerings and highly competitive bundled packages, including services that drive the take-up of fixed-line broadband, such as video on demand. In parallel, a declining trend in traditional fixed-line teledensity remains, with consumers switching to mobile networks and to fixed broadband for voice and data connectivity.

Even as fixed broadband penetration is now relatively high in the region, development efforts for new and enhanced high-capacity connectivity to further capture demand for fixed-line broadband will continue. We see the sector maintaining investment allocations on fiber broadband during 2022, which could lead to double-digit growth in the number of fiber subscribers.

We expect carriers to maintain competitive value offerings in the mobile postpaid business, underpinning positive net portability although denting ARPUs. We also expect ongoing migration to postpaid services from prepaid in the mobile segment, as well as

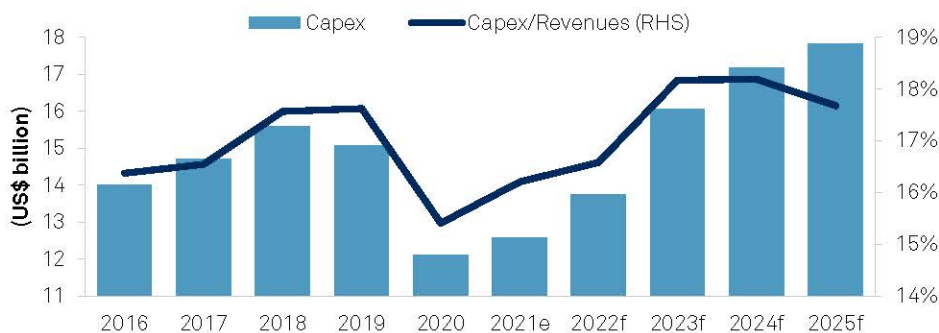
increased data usage in the next few years. In short, we expect profitability could come under pressure, although we're expecting the sector's EBITDA margins to remain comfortably above 30%.

Accelerated 5G deployment and network improvements lead to increasing capex. As the competitive landscape in Latin America continues to evolve, leading carriers not only intensify their efforts to protect and expand market share, but also execute multi-annual investments for network enhancements and technological upgrades. Wireless penetration continues to improve across the region and recent 5G spectrum auctions have been rolled out. We're expecting increasing competition for the deployment of 5G networks in countries like Chile, Brazil, Mexico, and Peru. Many carriers are actively participating in these auctions and take steps in terms of digital equity.

In our view, we should see an uptick in capital investments trending towards 20% of revenue, as companies deploy strategically important spectrum licenses and continue to extend FTTH coverage (see chart 14). We also anticipate funding allocations over the next two years mainly to increase fiber optic coverage, expand the existing 4G-4.5G footprint, increase the B2B installed capacity, and for maintenance purposes. This investment will likely constrain free operating cash flow, and for some companies delay deleveraging.

Chart 14

LatAm Capex Profile



e—Estimate. f—Forecast. Source: S&P Global Ratings.

Limited regulatory activity provides certainty on short-term industry dynamics in 2022. However, we could see updates to minimize market asymmetries and limit the excessive influence from the largest operators. In Brazil, regulator Anatel is planning a public consultation to update the general competition plan, which regulates the sector's competitive framework. Anatel will assess the effectiveness of current regulations to contain players with significant market power. We expect the resulting regulatory update would incorporate mechanisms to address new delivery models for telecom and connectivity services, particularly as 5G is rolled out. Also in Brazil, and similar to the Colombian model, Anatel is exploring regulatory sandboxes to test new business models that provide innovate improvements to market participants.

In Mexico, telecom regulator IFT is seeking to speed up dialogue with the productive and industrial sectors to maximize gains with 5G technology. It is also considering complementary initiatives under the 5G roadmap, including the reorganization of low, mid, and high spectrum bands to assign to 5G. Another priority will remain in 4G connectivity, as well as lowering the cost of spectrum and reordering frequencies.

The rollout of regulatory convergence has been rather slow, and this year we could see progress in the approval of significant pro-convergence regulations in certain jurisdictions like Mexico and Brazil. Argentina is one of the few large markets that has been recently pushing convergence, where Telecom Argentina holds the leading market position. In Chile, operators continue to deliver bundled packages of fast broadband and TV, and keep up upgrades from asymmetric digital subscriber lines to ultra-fast broadband to protect market share.

Credit metrics and financial policy

Following a two-year period of prudent financial management to address the high uncertainty triggered by the pandemic, this year we're expecting telcos in Latin America to normalize shareholder returns in the form of dividend payments and share repurchases. Yet we still expect a somewhat conservative leverage tolerance and liquidity to remain an important priority. These two factors can become particularly relevant under a scenario of tight financing conditions, if central banks decide to accelerate interest rates increases to contain inflationary pressures.

We also see as very unlikely that efforts to preserve cash during the pandemic would relax any time soon, particularly considering cost inflation pressures that are gradually undermining profitability. While we don't expect material improvements in leverage over the next couple of years due to greater capital spending and sluggish business conditions that would curtail EBITDA growth, we expect telcos to maintain a median debt-to-EBITDA ratio near 3x and funds from operations to debt in the 30% area, which speaks of the relative financial health that the region's Telecom sector has compared to other industries.

In addition, we expect issuers will continue to manage foreign exchange exposure to address the mismatch between local currency denominated revenues and foreign currency debt. Sovereign ceilings or parent company rating caps are still relevant factors that could weigh on a few investment-grade names.

Key risks or opportunities around the baseline

1. Initiatives to unlock shareholder value would also support credit quality.

Divestments and spin-offs would bolster targeted growth, profitability, and cash flow.

2. Weak economic conditions and sovereign risk still relevant credit factors

Telco's will have to cope with sluggish economic activity that can be exacerbated by persistent inflation, higher interest rates, weak labor dynamics, and political cycles.

3. Telcos should not lose sight of exchange rate volatility

A sudden period of exchange rate volatility could undermine cash flow and pressure balance sheets.

Initiatives to unlock shareholder value would also support credit quality. For 2022, we expect the implementation of strategic initiatives from different industry players, aimed towards accelerating growth and unlocking value for shareholders. One transaction relates to the creation of a joint venture between America Movil and Liberty Latin America (owner of VTR) to expand operations in Chile, with a focus on broadband and mobile services. In our view, this transaction could yield run-rate synergies of about \$180 million annually, mainly from cost efficiencies and service cross-selling.

We also expect the completion of America Movil's announced plan to spin off its telecom towers and other related passive infrastructure in the region, consisting of approximately 36,000 telecom towers in 15 countries. We don't see this type of initiative as indicating changes in strategic objectives or adjustments to the business model itself, but instead we think they signal the adoption of strategies to gain flexibility and improve operating efficiencies. We also think they can help develop targeted financial plans and capital allocations to spur growth and strengthen a carrier's competitive position, which can contribute to improved credit metrics.

In Chile, Telefonica Moviles Chile's (TMC's) divestment of its fiber optic network will allow for a faster deployment of network services in the next few years, and ultimately enable

Telefonica Chile to reduce capex that could alternatively fund the 5G rollout. This also creates opportunities for TMC to transition from its pay-TV business to broadband TV, which would contribute to incremental cash flow.

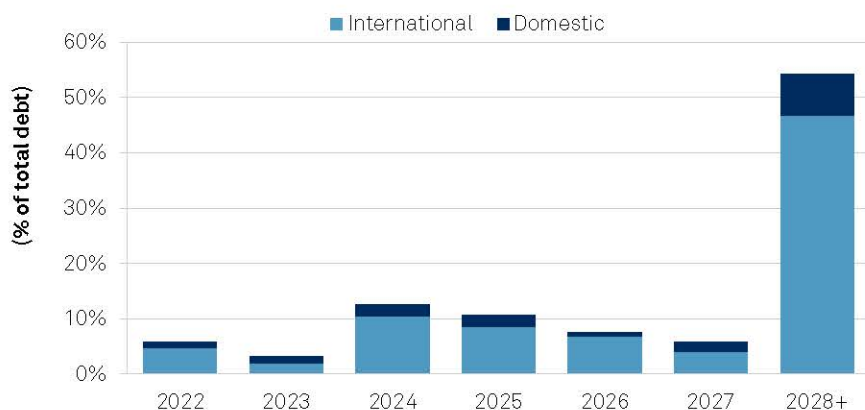
Weak economic conditions and sovereign risk are still relevant credit factors. We recently revised our 2022 GDP growth forecast for the six major Latin American economies downward by roughly half a percentage point--to 2% from 6.6% expected in 2021. This captures inflationary pressures that would be less transitory than expected, which will translate into higher interest rates across the region. Several factors also keep downside risks to growth particularly high in 2022. Slow growth, high inflation, and still-weak labor market dynamics amid political cycles, will increase demand for continued fiscal stimulus measures. This could add more upward pressure on interest rates to compensate for the associated higher fiscal risk premia and keep investment subdued. Two countries stand out for having a higher risk of GDP deteriorating more than expected in 2022: Chile and Brazil. In Chile, domestic demand surged in 2021 due in large part to sizable stimulus measures that are unlikely to be repeated in 2022. In Brazil, the ongoing aggressive tightening monetary policy that will continue into 2022, partly due to weaker fiscal dynamics, threatens to take a large toll on domestic demand.

This slow economic growth, coupled with political cycles in some countries, and the persistent return of COVID-19 waves could weigh on sovereign credit quality in some countries, which is an important consideration for some players in the region. For instance, the negative outlook on America Movil reflects potential downside risks related with the negative outlook on Mexico. In the case of Telefonica Brasil, we can rate the company above the Brazilian sovereign long-term foreign currency rating, although the rating is limited by Brazil's transfer and convertibility (T&C) assessment, since the company's operations are concentrated in that market. In the same way, we cap the rating on Telecom Argentina at the level of our T&C assessment on Argentina, because the bulk of the company's revenue and EBITDA come from domestic operations.

Telcos should not lose sight of exchange rate volatility. Exposure to exchange rate volatility is an important risk for telco operators in the region, considering that the sector faces a partial mismatch between local currency denominated revenues and foreign currency denominated debt, mostly in U.S. dollars. We expect that under a scenario of a sharp currency depreciation, cash flow could come under pressure and undermine the trajectory of credit metrics. Foreign currency debt accounts for about 80% of total debt held by telcos in the region, and the natural hedge on currency mismatch represents about 25% of those obligations (see chart 15). This means, that a 10% depreciation of the major currencies in the region could result in a contraction of operating cash flow and leverage could increase by as much as 0.2x.

Chart 15

LatAm Debt Maturity Profile



Source: S&P Global Ratings.

Asia Pacific

Ratings trends and outlook

Most telecom companies in Asia-Pacific (APAC) sustain steady and stable credit quality. This is on the back of our expectation that these companies will witness stable growth in their earnings and maintain prudent financial policy and disciplined capital investment over the next 12-24 months.

This steady and somewhat improving trend was reflected in some of the rating actions we took over the past 12 months. We revised our outlook to stable from negative on Hong Kong Telecommunications (HKT) Ltd. on parent PCCW Ltd.'s deleveraging progress. We revised our outlook on Bharti Airtel Ltd. to stable from negative on account of the company's strengthening operations and leverage management. We also took a similar rating action on SK Telecom Co. Ltd., revising our outlook to stable from negative reflecting its improving operating performance.

Main assumptions about 2022 and beyond

1. Operating performance should remain steady despite a prolonged pandemic

Most APAC telecom operators can maintain steady operating and financial performances amid a prolonged pandemic, owing to the sector's low cyclical and utility-like demand characteristics.

2. Capital spending will remain elevated amid continued investments for advanced networks such as 5G and newer growth areas

We expect capex to remain high next year with continued 5G deployment and network upgrades. Continued large capital investment is likely for 5G networks in Korea, China, Japan, and Australia. We anticipate rising capex for 5G expansion in Singapore and the Philippines. Also, we expect ongoing capital investment by certain operators in the field of ICT as they look at digitalization and increasing cloud usage as newer growth avenues.

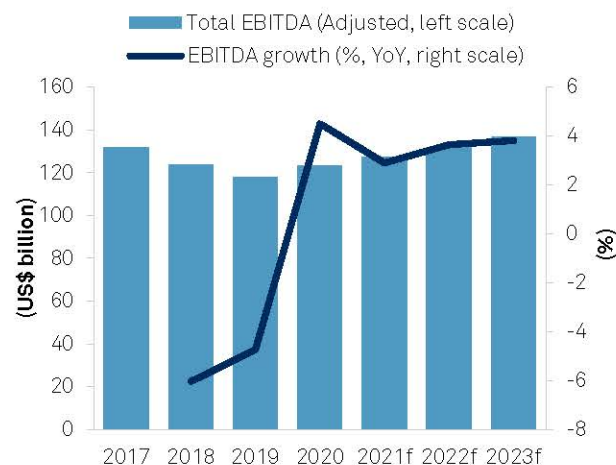
3. M&A and business restructuring trends will continue

We expect continued acquisition activity in the region given the telecom-media convergence trend and the appetite of some telcos to restructure their businesses such as spinoff and monetization of tower assets.

Operating performance should remain steady despite a prolonged pandemic. Although the world remains in the grasp of the pandemic and related economic stress owing to the omicron variant, we believe the sector will continue to be immune to material negative impacts thanks to its utility-like demand characteristics and low cyclical nature. Furthermore, continued expansion in demand for data amid stay-at-home trends will help telcos boost earnings as users opt for higher priced data plans (5G, high speed, and higher data limit plans) for their wireless and fixed-broadband connections. Still, some operators in APAC will witness a delayed rebound in their roaming revenue as international travel faces new concerns given omicron. Overall, under our base-case scenario, we expect moderate earnings growth for telcos in 2022 (see chart 16).

Chart 16

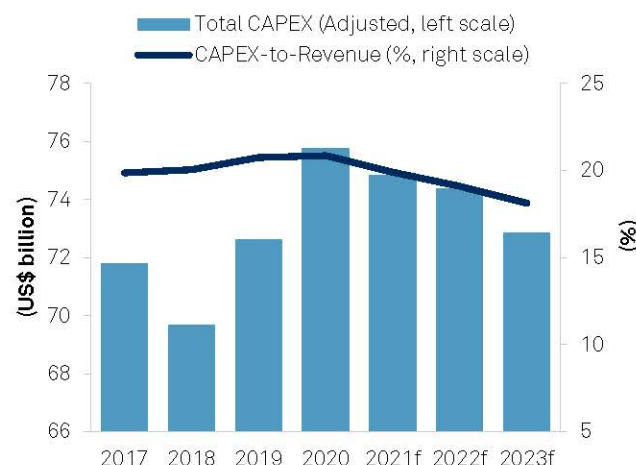
APAC Telcos' EBITDA To Moderately Grow In 2022



f—Forecast. Source: S&P Global Ratings.

Chart 17

APAC Telcos' Capex To Remain Elevated Over Next 12-24 Months Amid Needs To Deploy Advanced Networks Such As 5G



f—Forecast. Source: S&P Global Ratings.

Capital spending will remain elevated. We expect ongoing capex needs for APAC telcos in 2022 as they expand deployment of advanced networks such as 5G (see chart 17). In our view, high capital investments for 5G networks will continue, albeit in a disciplined manner, in developed markets such as Korea, China, Australia, Japan, Taiwan, and Hong Kong. We expect telcos in these regions take measured approaches in their investment plans given advanced enterprise and industrial use cases are still in varying degrees of development and some years away. However, in regions such as Singapore and the Philippines, we anticipate rising capex for 5G network expansion over the next two years. We also expect ongoing capital investments by certain operators in the field of ICT as they look at digitalization and increasing cloud usage as newer growth avenues.

M&A and business restructuring trends will continue. In the region, operators are pursuing cost synergies, economies of scale, and telecom-media convergence. In Korea, all three telecom players (KT Corp, SK Telecom Co. Ltd. (SKT), and LG Uplus Corp.) have acquired cable TV operators to strengthen their media and pay-TV market position. In Malaysia, Axiata Group Bhd.'s Malaysia subsidiary plans to merge with Telenor ASA's Malaysia subsidiary. In Thailand, Total Access Communication Pcl, subsidiary of the second-largest operator Telenor ASA's announced its merger with the country's third-largest operator True Corp. Axiata also recently announced an acquisition of broadband and cable TV operator PT Link Net Tbk. There was also acquisition of Amaysim (Australia's largest mobile virtual network operator) by Singtel Optus.

At the same time, some telecom operators are restructuring their businesses. Telstra, Singtel Optus, and CK Hutchison Group Telecom have recently monetized their telecom infrastructure assets, while SK Telecom in late 2021 split its existing business by creating a separate holding company for its ICT businesses.

Key risks or opportunities around the baseline

1. Growing 5G services

We continue to see steady new subscriptions for 5G services across markets such as Korea, China, Japan, and Australia since its launch. However, new and profitable industrial 5G use cases are still fairly distant and will remain a challenge for operators globally over the next few years.

2. Intense competition

Operators in many APAC markets, such as Malaysia, Thailand, Singapore, the Philippines and Japan, are continuing with aggressive pricing strategy and marketing to maintain their market positions. Entrance of new operators in Japan (Rakuten Inc.), Singapore (TPG), and Philippines (Dito Telecommunity Corp.) has further intensified wireless market competition.

3. Deeper recession

Although benefiting from utility-like demand characteristics, a deep recession with reduced spending on telecom services and rising bad debt could dent the region's telecom operators. High cost inflation and scare related to omicron could also impair earnings recovery for these operators.

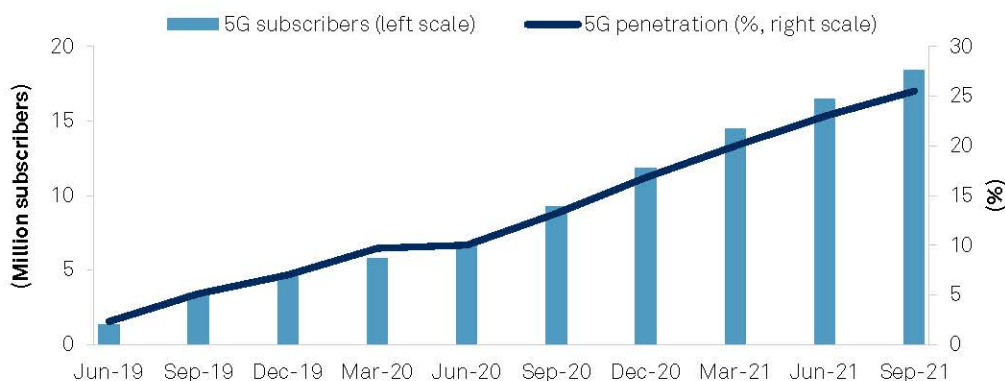
5G service is increasing. 5G adoption remains steady but more profitable use cases still remain distant. After Korea's 5G rollout began in April 2019--followed by Australia, China, and Japan--we see steady new 5G subscriptions (see chart 18). Despite potential revenue growth opportunities from higher 5G wireless tariffs, telecom operators need to manage investment burdens for 5G spectrum auctions and network expansions as developing new and profitable 5G use-cases still remain challenging for all operators.

Competition remains intense. This includes wireless tariff cuts or aggressive marketing in countries such as the Philippines, Singapore, Japan and Thailand. Entrance of new operators in Japan (Rakuten Inc.), Singapore (TPG Telecom) and Philippines (Dito Telecommunity Corp.) have further increased wireless competition.

A prolonged pandemic could lead to a deeper recession. Sluggish Asia-Pacific economies, reduced spending on telecom services, and rising bad debt may dent the region's telecom operators. Also, growing concerns related to omicron's spread and sustained high inflation may also derail the earnings recovery expected in 2022.

Chart 18

Cumulative 5G Subscribers In Korea



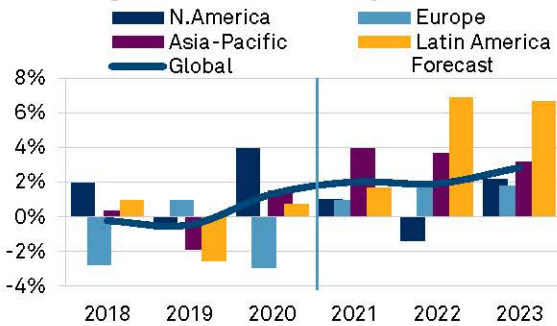
Sources: S&P Global Ratings, Ministry of Science and ICT, Korea.

Industry forecasts

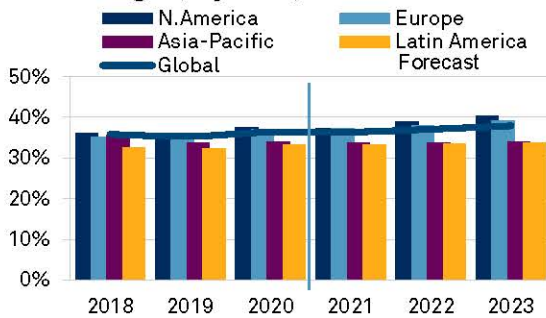
Telecommunications – Fixed and Wireless

Chart 19

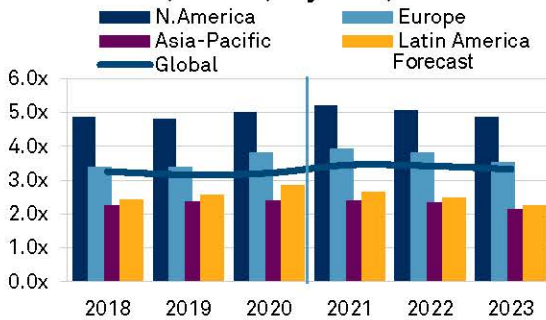
a) Revenue growth (local currency)



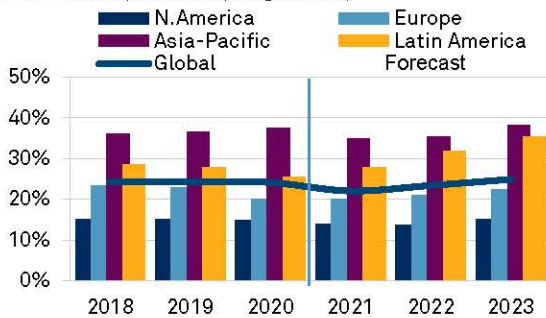
b) EBITDA margin (adjusted)



c) Debt / EBITDA (median, adjusted)



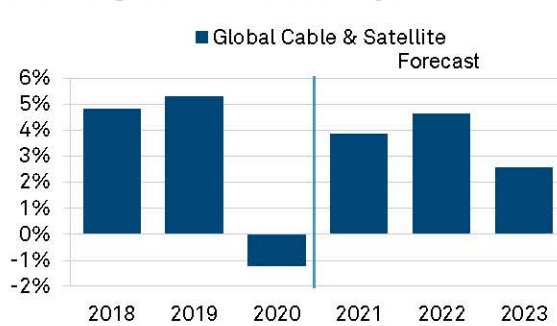
d) FFO / Debt (median, adjusted)



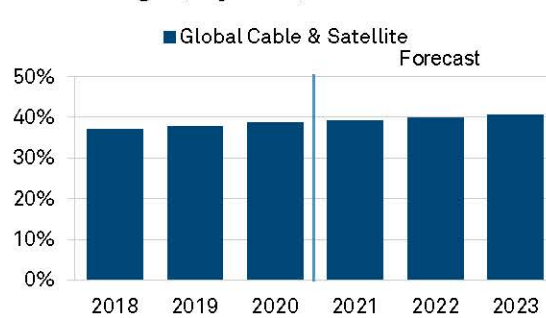
Cable and Satellite

Chart 20

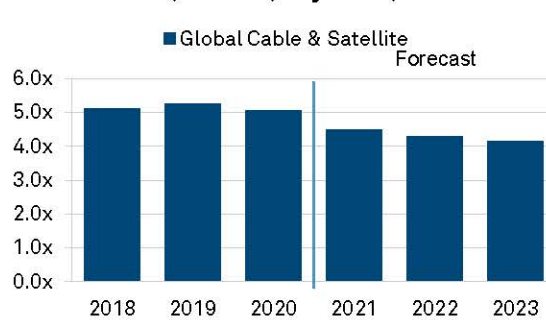
a) Revenue growth (local currency)



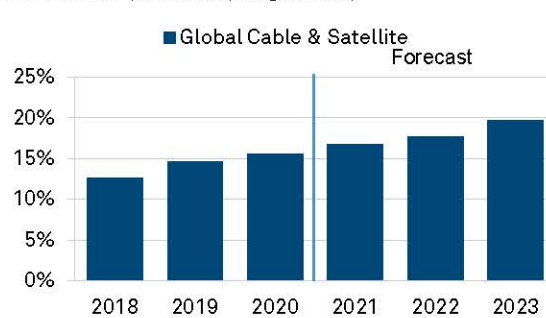
b) EBITDA margin (adjusted)



c) Debt / EBITDA (median, adjusted)



d) FFO / Debt (median, adjusted)



Source: S&P Global Ratings. Revenue growth shows local currency growth weighted by prior-year common-currency revenue-share. All other figures are converted into U.S. Dollars using historic exchange rates. Forecasts are converted at the last financial year-end spot rate. OEMs—Original equipment manufacturers. FFO—Funds from operations.

Cash, debt, and returns

Global Telecommunications

Chart 21

Cash flow and primary uses

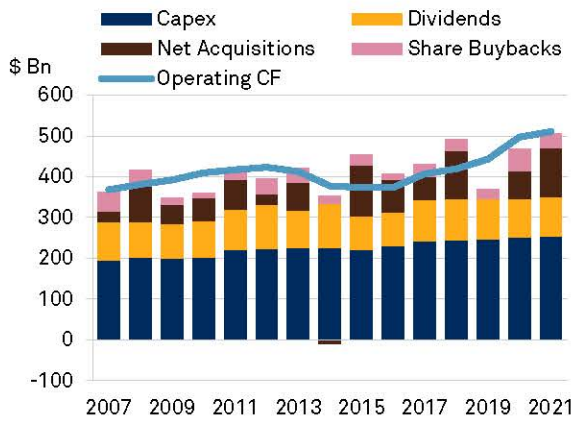


Chart 22

Return on capital employed

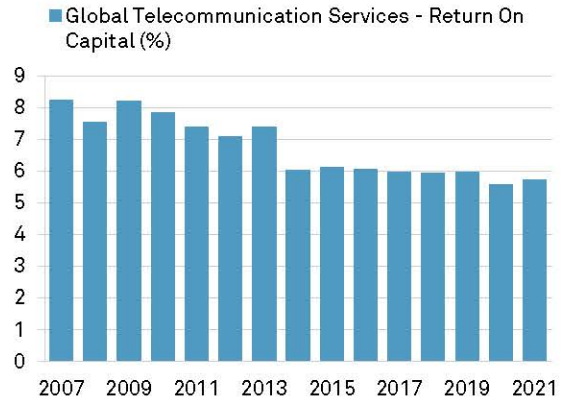


Chart 23

Fixed versus variable rate exposure

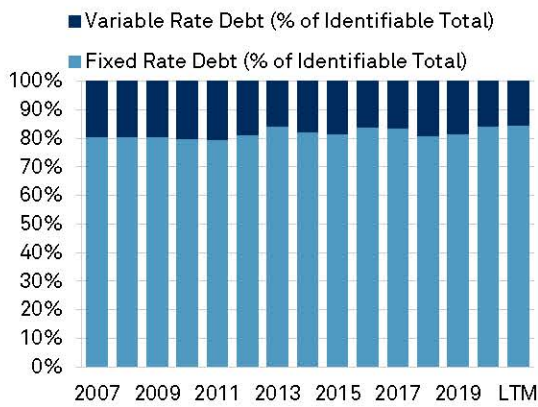


Chart 24

Long term debt term structure

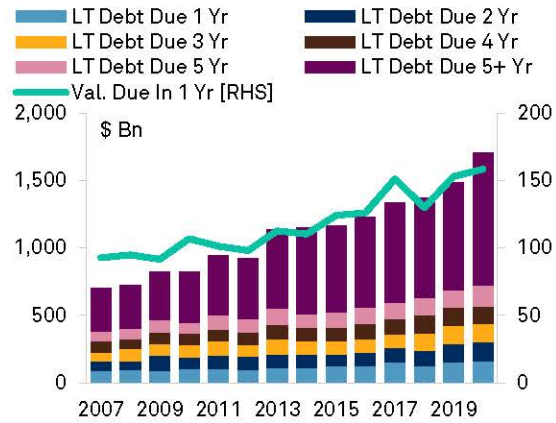


Chart 25

Cash and equivalents / Total assets

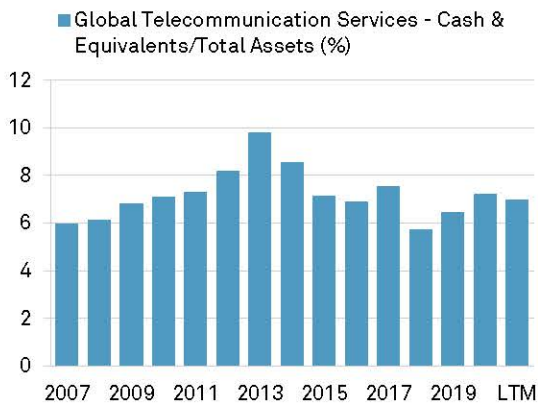
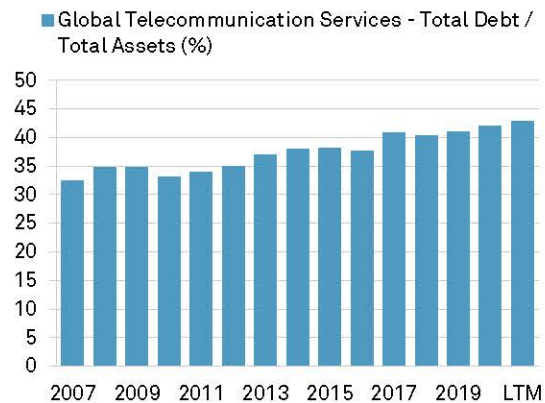


Chart 26

Total debt / Total assets



Source: S&P Global Market Intelligence, S&P Global Ratings calculations. Most recent (2021) figures are using last twelve months (LTM) data.

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Telstra August 2022 Debt Investor Update

Guy Wylie – Finance Executive, Group Treasurer

Nathan Burley – Head of Investor Relations

Brent Luetjens – Investor Relations

Susie Maiuto – Treasury

Simon O'Brien - Treasury

Disclaimer



Forward-looking statements

This presentation includes forward-looking statements. The forward-looking statements are based on assumptions and information known by Telstra as at the date of this presentation.

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A number of these risks, uncertainties and other factors are described in the "Chairman & CEO Message", "Our material risks" and "Outlook" sections of our Operating and Financial Review (OFR). The OFR is set out in Telstra's financial results for the year ended 30 June 2022 which were lodged with the ASX on 11 August 2022, and are available on Telstra's Investor Centre website www.telstra.com.au/aboutus/investor.

In addition, there are particular risks and uncertainties in connection with the implementation of the Telstra's T25 strategy (T25). Detailed business plans have not been developed for the entirety of the strategy and the full scope and cost of T25 may vary as those plans are developed. Further there are risks associated with the Telstra Group's ability to execute and manage the elements of T25 in a sequenced, controlled and effective manner and realise the planned benefits, cost savings and growth opportunities. There are also risks and uncertainties in connection with the proposed legal restructure announced on 22 March 2021. Any restructure is a complex process and we are navigating a range of existing commercial, regulatory, operational and other requirements. There may therefore be delays in implementing some parts of the restructure, or they may not be implemented.

Telstra does not provide financial guidance beyond the current financial year. Telstra's financial ambitions to FY25 and growth ambitions across our portfolio are not guidance and there are greater risks and uncertainties in connection with these ambitions.

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All market share information in these presentations is based on management estimates having regard to internally available information unless otherwise indicated.

Other information

All amounts are in Australian Dollars unless otherwise stated.

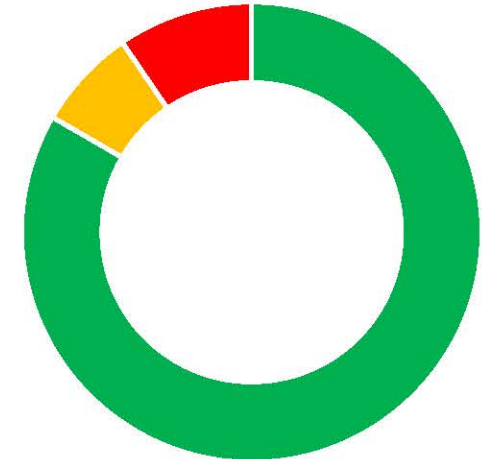
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T22 achievements



<h2>Simplification & Digitisation</h2>	<ul style="list-style-type: none"> 10.2m services on 20 simplified C&SB in market plans 4.5m Telstra Plus members C&SB digital sales increased to 48% and digital service interactions increased to 77% 71% reduction in annual contact centre calls since FY18 100% of calls from C&SB customers now answered in Australia Enterprise digital service interactions increased to 41%
<h2>Ways of working</h2>	<ul style="list-style-type: none"> Leaner, more efficient organisation including >17k working in Agile FTE reduction by >one-third or 26k across direct and indirect Hybrid working for all office based and contact centre employees
<h2>Productivity</h2>	<ul style="list-style-type: none"> >\$2.7b cost reduction since FY16 >\$2b asset monetisation – almost \$5b including Amplitel
<h2>Network leadership</h2>	<ul style="list-style-type: none"> Australia's largest 5G network with 80% of population covered 3.5m 5G capable devices connected to the Telstra mobile network National lead in combined 4G/5G speeds
<h2>Infrastructure</h2>	<ul style="list-style-type: none"> Completed 49% disposal of interest in Amplitel for \$2.8b Proposed legal restructure: pending Court approval, we will shortly publish a Scheme Booklet giving shareholders information they need to vote at Scheme Meeting to be held on the same day as our AGM

T22 scorecard metrics ~80% metrics completed



- Completed
- Significant progress but below target metric
- Below target metric

Financial headlines



FY22 Reported

Total income: \$22.0 billion, -4.7%

EBITDA: \$7.3 billion, -5.0%

EBITDA lease adjusted²: \$7.3 billion, -2.5%

NPAT: \$1.8 billion, -4.6%

EPS: 14.4 cents, -7.7%

Total dividend: 16.5 cents per share⁴, +3.1%

FY22 Guidance basis¹

Underlying EBITDA³: \$7.3 billion, +8.4%

In-year nbn headwind³: ~\$340 million (LTD ~\$3.6 billion)

Underlying EPS³: 14.4 cents, +48.5%

Capex³: \$3.0 billion, +0.7%

Free cashflow after lease payments³: \$4.0 billion, +5.9%

1. This guidance excludes material one-offs, such as mergers and acquisitions, disposals, impairments, spectrum, restructuring costs and such other items as determined by the Board and management. Refer to Full year results and operations review – guidance vs reported results reconciliation (set out in our ASX announcement titled “Financial results for the full year ended 30 June 2022” lodged with the ASX on 11 August 2022).

2. ‘Reported lease adjusted’ includes all mobile handset leases as operating expenses in FY21.

3. Refer to definition in the Glossary.

4. Total dividend of 16.5 cents per share fully franked comprising total ordinary dividend of 13.5 cents per share and total special dividend of 3 cents per share.

Operating highlights



Continuing to deliver growth

Mobile service net adds

- +155k retail postpaid handheld services including +121k branded +34k Belong
- +215k retail prepaid handheld unique users
- +218k wholesale MVNO including prepaid and postpaid services
- +1,024k IoT services

Fixed service net adds

- -87k retail fixed bundle and data services

- **Mobile:** +2.9% postpaid handheld ARPU growth, +14.2% prepaid handheld services revenue growth, +6.4% total services revenue growth, +\$700m EBITDA growth
- **Fixed – C&SB:** +2.4% bundles and data ARPU growth
- **Enterprise** income and EBITDA growth. **Fixed – Enterprise** +2.3% EBITDA growth, +\$152m NAS EBITDA growth
- **InfraCo Fixed:** \$2.4b income, +3.1% core access growth
- **Telstra Health:** +13% organic revenue growth, +51% overall revenue growth to \$243m

Improved customer experience

- Episode NPS improved +5 last 12 months and maintained last six months
- Strategic NPS declined -5 last 12 months and -1 last six months

Continued cost reduction

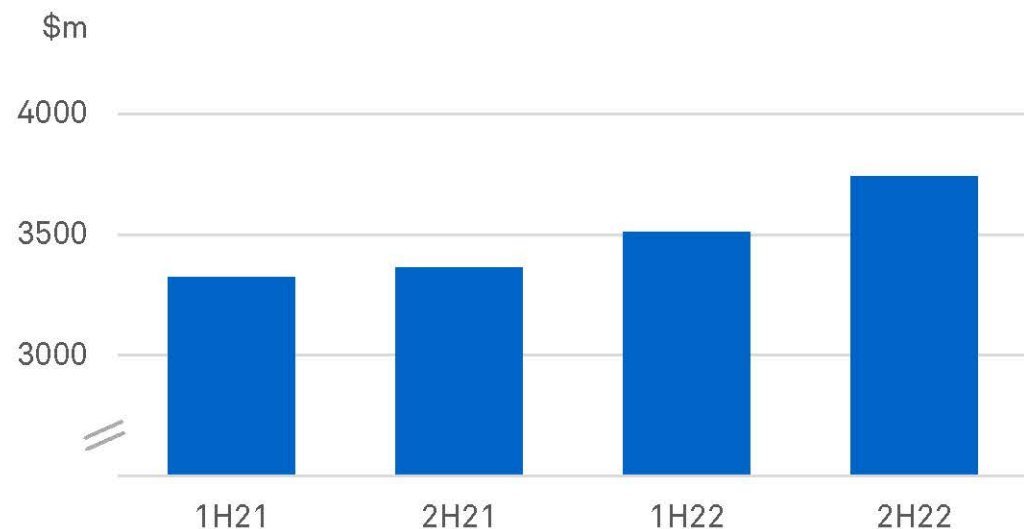
- >\$2.7b underlying fixed cost reduction since FY16
- FY22: \$454m or 8.1% underlying fixed cost reduction and \$906m or 5.8% decline in total operating expenses¹

1. 'Reported lease adjusted' includes all mobile handset leases as operating expenses in FY21.

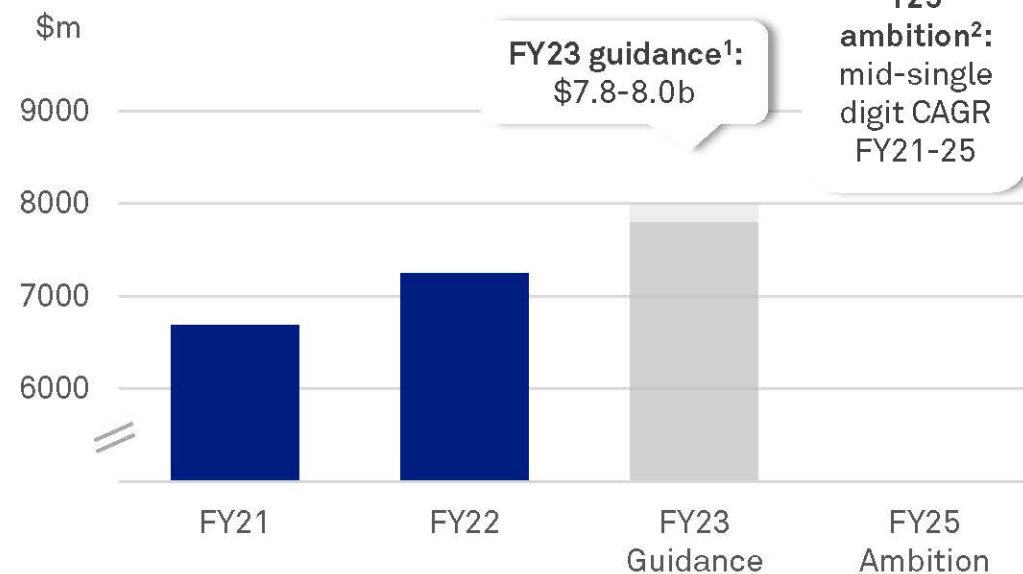
Underlying EBITDA growth



Underlying EBITDA – halves



Underlying EBITDA – full year



1. This guidance excludes material one-offs, such as mergers and acquisitions, disposals, impairments, spectrum, restructuring costs and such other items as determined by the Board and management. Refer to slide “FY23 guidance”.

2. Telstra’s financial ambitions for its Underlying EBITDA and FY25 outcomes are not guidance and there are greater risks and uncertainties in connection with these ambitions.

EBITDA by product¹



	FY21	CHANGE \$m	FY22	CHANGE	
Mobile	\$3,297m	700	\$3,997m	21.2%	Service revenue growth, plan structure, hardware and productivity
Fixed - C&SB	\$139m	-84	\$55m	-60.4%	Revenue reduction, growing nbn costs, partly offset by cost out
Fixed - Enterprise	\$645m	15	\$660m	2.3%	NAS growth offset by data & connectivity decline
Fixed - Active Wholesale	\$231m	-72	\$159m	-31.2%	Ongoing legacy decline partially offset by cost-out
International	\$336m	51	\$387m	15.2%	0.5% constant currency growth
InfraCo Fixed	\$1,673m	-18	\$1,655m	-1.1%	nbn commercial works decline offset by disposals
Amplitel	\$300m	-6	\$294m	-2.0%	Revenue growth offset by build up of costs as standalone business
Other ²	\$68m	-24	\$44m	NM	Includes corporate adjustments; Health flat yoy
Underlying	\$6,689m	562	\$7,251m	8.4%	
Net one-off nbn DA	\$802m	-569	\$233m	-70.9%	Reflects nbn migration timing
Restructuring	-\$211m	140	-\$71m	66.4%	
Other guidance adj. ³	\$164m	-321	-\$157m	NM	Gain on sales in pcp; Towers transaction costs in FY22
Reported lease adjusted¹	\$7,444m	-188	\$7,256m	-2.5%	

1. Mobile and Fixed products include internal infrastructure costs. 'Reported lease adjusted' includes all mobile handset leases as operating expenses in FY21. No adjustment in FY22.

2. Other includes miscellaneous and Telstra Health.

3. Refer to Full year results and operations review – guidance vs reported results reconciliation which details the adjustments made for the current and comparative period to reflect performance on the basis on which we provided guidance to the market for FY22 (set out in our ASX announcement titled "Financial results for the Full year ended 30 June 2022" lodged with the ASX on 11 August 2022).

Product highlights: mobile momentum and growth

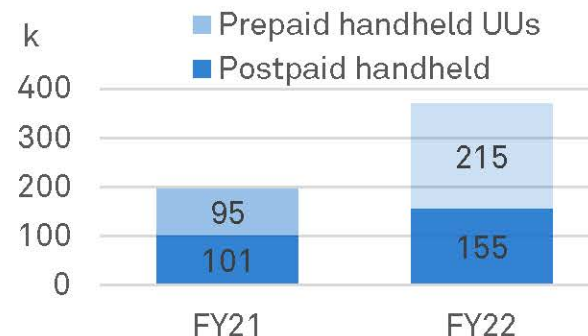


Mobile service revenue growth



All products and segments growing
 Mid-single digit growth ambition to FY25
 Key driver of EBITDA growth

Mobile handheld net adds



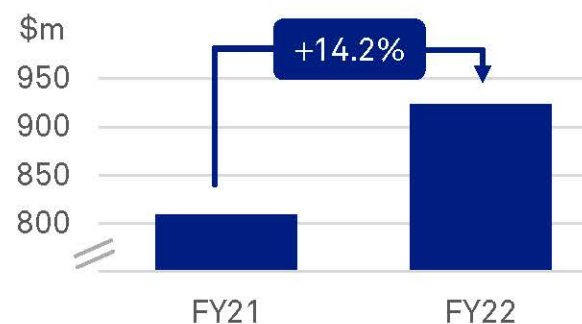
SIO growth across all segments including strong contribution from Enterprise

Mobile postpaid handheld ARPU growth



Growth driven by price changes
 Economic growth > reported
 Price rises/CPI indexation and roaming to support FY23 growth

Mobile prepaid handheld revenue growth

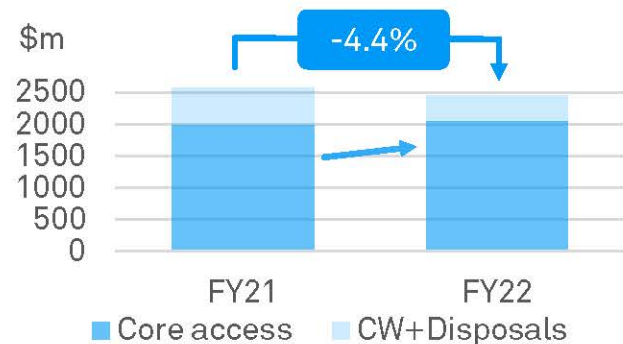


Growth from unique users, lower dormancy, and higher ARPU

Product highlights: Infrastructure



InfraCo Fixed revenue



+3.1% growth in core access revenue for fibre, network sites & ducts

Legacy network disposals

Offset by nbn commercial works (CW) rolling off as nbn rollout nears completion & contracts end

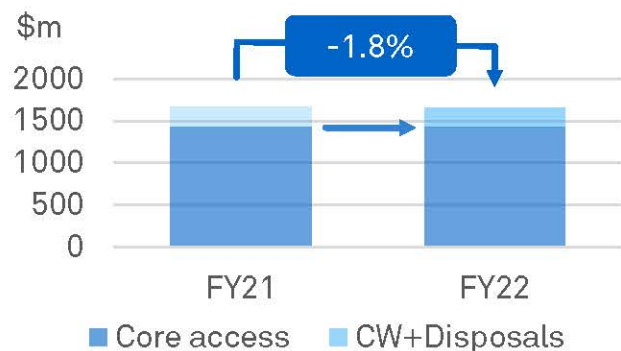
nbn recurring revenue growth



Average contracted period of 25 years

CPI indexed

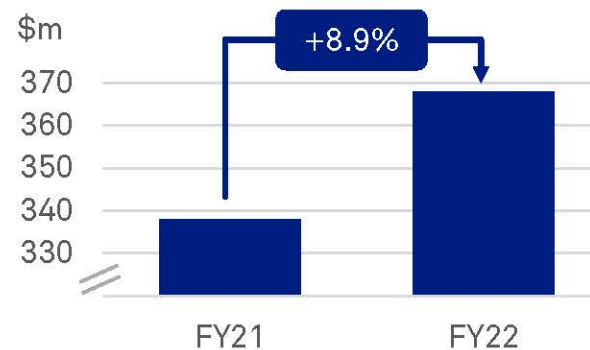
InfraCo Fixed EBITDAaL¹



Flat core access EBITDAaL on additional investment in maintenance and growth opportunities

Additional long-term growth potential including from major infrastructure investments

Amplitel (Towers) revenue growth



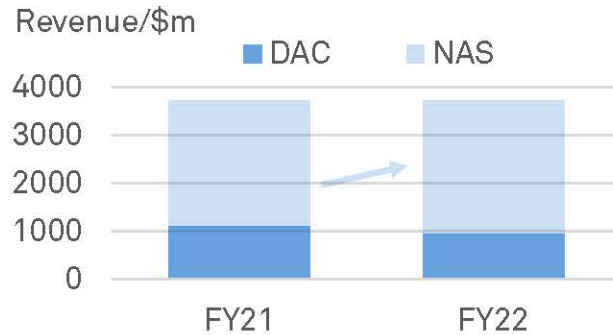
Demand including new builds and 5G coverage expansion from Telstra

1. Refer to definition in the Glossary.

Product highlights: Fixed - Enterprise

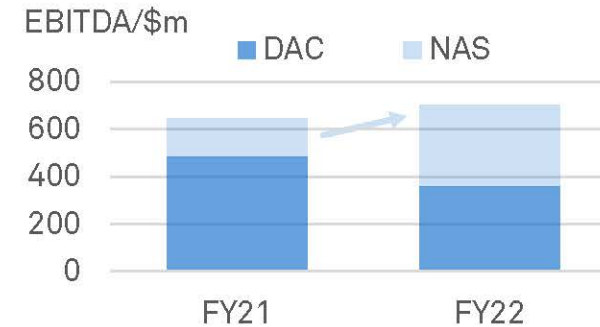


NAS growth offsetting DAC declines¹



Fixed - Enterprise revenue decline -0.7%¹

Including NAS revenue growth +4.6%¹



Fixed - Enterprise EBITDA growth +2.3% or \$15m

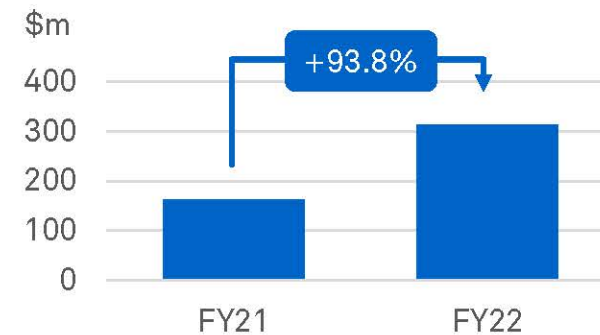
Including NAS EBITDA growth +\$152m

Data & connectivity (DAC) revenue decline



ARPU reduction from competition (incl. nbn) and tech change
 Strong contract renewals of our government and enterprise customers. T-Fibre churn largely confined to mid-market/business
 Return to growth challenged

NAS EBITDA growth



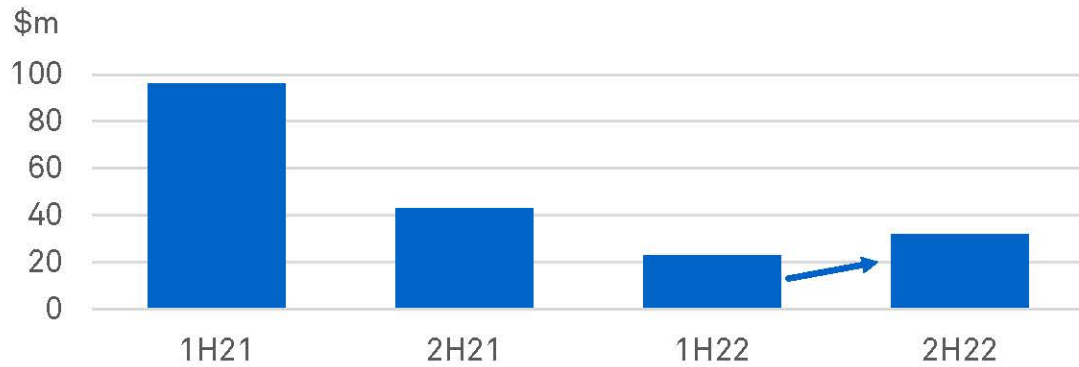
Security, Cloud, IoT, professional & managed services growth offset legacy and calling declines
 Timing of revenue recognition linked to key contract milestones
 Strong cost management
 Mid-teens margin ambition by FY25

1. Excludes \$32m in FY22 of NAS Professional services income contribution from acquisitions. Including acquisitions NAS revenue +5.8% and Fixed - Enterprise revenue +0.1%.

Product highlights: Fixed - C&SB has bottomed

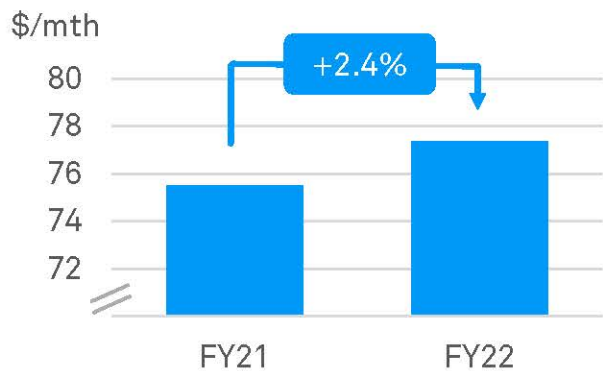


Fixed - C&SB EBITDA – 2H22 grew sequentially on 1H22



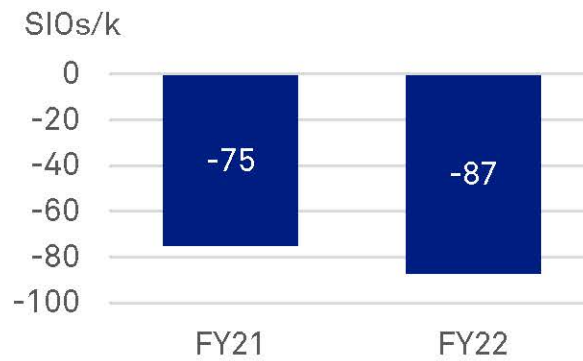
nbn migration of data SIOs ~99% complete in nbn fixed footprint
 nbn reseller EBITDA margin 5% in FY22 with target for >8% by FY23
 Improvements in experience and productivity from new stack/digitisation
 Growing 5G Home wireless contribution
 Bundles & data revenue flat

Bundles & Data ARPU growth

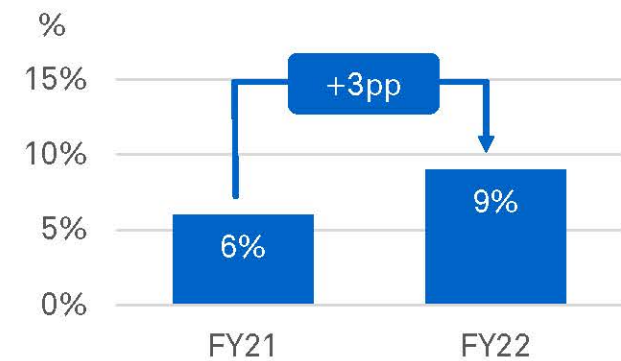


Growth from price changes and improved plan mix
 Full year benefits to flow through into FY23

Bundles & Data net adds



nbn plan mix 100mpbs+



Operating expenses¹



	FY21	CHANGE \$m	FY22	CHANGE
Sales costs - nbn payments	\$1,975m	106	\$2,081m	5.4%
Sales costs - other	\$6,209m	-170	\$6,039m	-2.7%
Fixed costs - underlying	\$5,593m	-454	\$5,139m	-8.1%
Fixed costs - other ²	\$1,384m	-345	\$1,039m	-24.9%
Underlying	\$15,161m	-863	\$14,298m	-5.7%
One-off nbn DA and nbn C2C	\$248m	-103	\$145m	-41.5%
Restructuring	\$211m	-140	\$71m	-66.4%
Other guidance adjustments	\$44m	200	\$244m	NM
Reported lease adjusted	\$15,664m	-906	\$14,758m	-5.8%

Total operating expenses¹ declined 5.8%

nbn™ network payments increased driven by higher tier-mix and Connectivity Virtual Circuit (CVC) charges

Sales costs – other declined including lower volumes of modems and mobile handsets, and reduced Foxtel service fees

Underlying fixed costs decreased \$454m or 8.1% in FY22

Achieved cumulative \$2.7b per annum cost out target - a 35% net reduction in annual underlying fixed costs since FY16

Cost reduction achieved by simplifying product offerings, increasing digital experiences, reducing layers of management and moving to an agile workforce, optimising 3rd party spend and due to the migration of customers to nbn

Fixed costs - other reduction due to mobile handset leases ceasing in FY21 and reduced commercial works, partially offset by costs to operate our newly insourced retail stores

1. 'Reported lease adjusted' includes all mobile handset leases as operating expenses in FY21. No adjustment in FY22.

2. Includes items supporting revenue growth including relevant NAS costs, mobile handset lease, product impairment, and additional costs from insourcing retail channel in FY22.

Inflation and mitigants



Operating expenses	FY22	Components	Actively addressing cost challenges with mitigants
Sales costs – nbn payments	\$2,081m		<ul style="list-style-type: none"> • Network payments generally not inflationary and largely pass through • Hardware COGS largely pass through • Other sales including NAS cost of sales with some inflationary pressure but largely pass through. Also includes largely historic commissions
Sales costs – other	\$6,039m		
Fixed costs – underlying	\$5,139m		<ul style="list-style-type: none"> • Labour/Labour substitution. Enterprise Agreement for wages. FY22 +82 employee engagement score • Service contracts & agreements (SC&A). Inflationary but partially contracted • Energy costs FY22 ~\$250m. Substantive protection through Power Purchase Agreements. • Other including property, IT, promotion, advertising, travel, entertainment, bad debt – inflationary but partially discretionary
Fixed costs – other	\$1,039m		
Underlying	\$14,298m		

Revenue

- **\$5b of mass market mobile services** - price increase inline with CPI + annual price review
- **\$0.9b nbn receipts** indexed to CPI
- Ongoing assessment of pricing

Other costs include fixed components

- **\$0.8b leases.** Average contracted term 8 years with majority fixed contracted increases rather than CPI. Also optimising portfolio
- **\$0.4b net finance costs.** ~65% of debt fixed. +100bps = ~-\$20m NPAT impact in FY22

Capex

- ~75% subject to inflationary pressure, remainder protected by contracts and EA
- Committed to envelope. In year we may make trade-offs and adjust timing

FY23 guidance



	FY22	FY23 guidance ¹ (includes Digicel Pacific)
Total Income	\$22.0b	\$23.0b to \$25.0b
Underlying EBITDA²	\$7.3b	\$7.8b to \$8.0b
Capex³	\$3.0b	\$3.5b to \$3.7b (incl. strategic investment)
Free cashflow after lease payments (FCFaL)⁴	\$4.0b	\$2.6b to \$3.1b (incl. strategic investment)

1. This guidance excludes material one-offs, such as mergers and acquisitions, disposals, impairments, spectrum, restructuring costs and such other items as determined by the Board and management.
2. Underlying EBITDA excludes net one-off nbn DA receipts less nbn net C2C and guidance adjustments.
3. Capex is measured on an accrued basis and excludes spectrum and guidance adjustments, externally funded capex, and capitalised leases.
4. Free cashflow after lease payments defined as 'operating cash flows' less 'investing cash flows' less 'payments for lease liabilities', and excludes spectrum and guidance adjustments.



Our strategy: T25

Our purpose and values

To build a connected future so everyone can thrive

We are changemakers

We are better together

We care

We make it simple

Our strategic pillars

An exceptional customer experience you can count on

Leading network & technology solutions that deliver your future

Sustained growth and value for our shareholders

Excelling at new ways of working

The place you want to work

Accelerating digital leadership

Doing business responsibly

Our businesses

Consumer & Small Business

Enterprise

New Markets

International

Infrastructure

Capital position



	FY21	1H22	FY22	
Gross debt	\$16.4b	\$14.9b	\$13.8b	
Cash and cash equivalents	\$1.1b	\$1.7b	\$1.0b	
Net debt	\$15.3b	\$13.2b	\$12.7b	
Average gross borrowing cost ¹	3.8%	3.7%	3.7%	
Average debt maturity (years) ¹	3.4	3.3	3.1	
Financial parameters² Comfort Zones				
Debt servicing	1.5 - 2.0x	2.0x	1.9x	1.8x
Gearing	50% to 70%	50.0%	43.1%	43.0%
Interest cover	>7x	13.2x	13.0	14.5
Ratios				
Capex ³ to sales	14.4%	13.4%	14.5%	
ROE ³	12.8%	9.1%	11.3%	
ROIC ³	7.5%	6.0%	7.1%	
Underlying ROIC ³	5.0%	6.2%	7.0%	

Net debt declined ~\$2.6b in FY22 supported by our free cashflow and proceeds from disposal of interest in our Towers business

Average gross borrowing cost declined marginally over FY22. Debt portfolio is hedged at ~ 65% fixed interest

Strong liquidity. \$1.0b cash and \$3.8b of unused committed bank facilities

Balance sheet strength and flexibility. Improved debt servicing ratio driven by reducing net debt. Digicel Pacific acquisition increases proforma debt servicing ~0.1x.

Accrued capex³ of \$3,042m in FY22 (guidance basis)

Momentum to FY23 Underlying ROIC target of ~8%

1. Excludes leases.

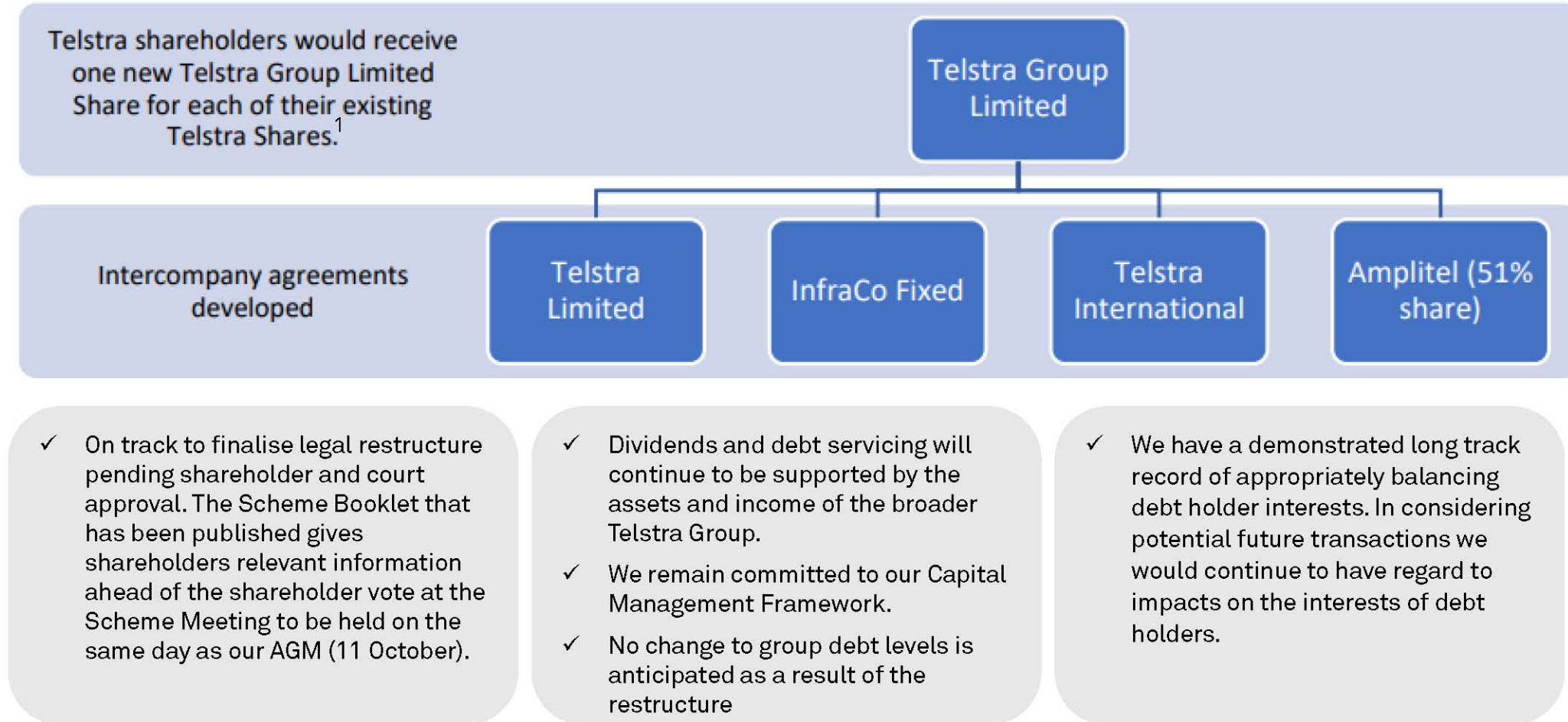
2. Debt servicing calculated as net debt over reported EBITDA. Gearing calculated as net debt over total net debt and equity. Interest cover calculated as reported EBITDA over net interest expense (excluding capitalised interest, revaluation impacts on our borrowings and derivatives and other non-cash accounting impacts).

3. Refer to definition in the Glossary.

Update on Corporate Restructure



Telstra's proposed legal structure



¹ Unless you are an Ineligible Foreign Shareholder – see section 6.4 of the Scheme Booklet for more information

Capital management framework



Fiscal discipline

Objectives

 **Maximise returns for shareholders**

 **Maintain financial strength**

 **Retain financial flexibility**

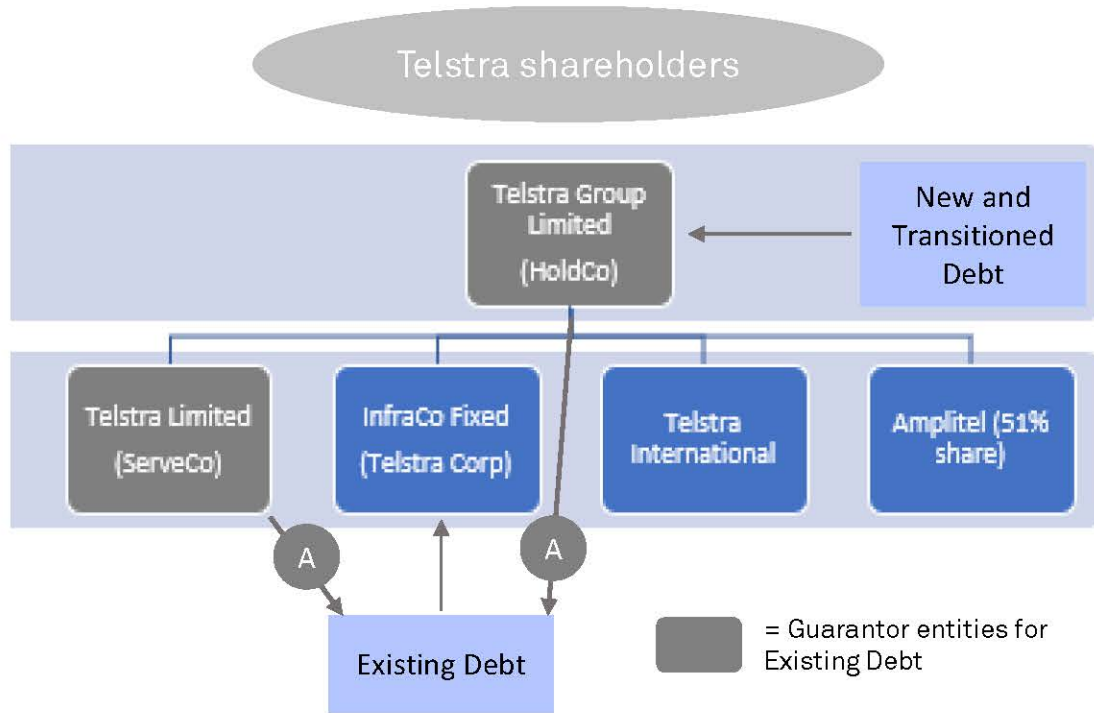
Principles

1. Committed to balance sheet settings consistent with an A band credit rating
2. Maximise fully-franked dividend and seek to grow over time¹
3. Ongoing business-as-usual capex of ~\$3b p.a. excluding spectrum²
4. Invest for growth and return excess cash to shareholders

1. The dividend is subject to no unexpected material events and is subject to Board discretion having regard to financial and market conditions, business needs and maintenance of financial strength and flexibility consistent with Telstra's capital management framework.

2. Capex is measured on an accrued basis and excludes spectrum and guidance adjustments, externally funded capex, and capitalised leases.

Update on Debt Structure



- ✓ Existing external debt will initially remain in Telstra Corp Ltd (to become InfraCo Fixed), with refinancing of existing external debt (including by transfer, substitution or otherwise) and new debt raising expected at Telstra HoldCo
- ✓ We have enhanced the previously announced guarantee structure to add ServeCo as an additional guarantor (i.e. in addition to Telstra HoldCo) to support existing external debt at InfraCo Fixed (see 'A' in the diagram to the left) (“**Existing Debt Guarantee**”)
- ✓ This guarantee structure will have features allowing the Existing Debt Guarantee from Telstra HoldCo to be released upon a change of control of InfraCo Fixed (subject to certain additional conditions)

Glossary



Term	Definition (unless separately defined in the slide footnotes)
Capex, Accrued Capex	Capex is measured on an accrued basis and excludes spectrum and guidance adjustments, externally funded capex, and capitalised leases
Free cash flow after lease payments (FCFaL)	'operating cash flows' less 'investing cash flows' less 'payments for lease liabilities', and excludes spectrum and guidance adjustments
Guidance adjustments	Guidance adjustments include material one-offs, such as mergers and acquisitions, disposals, impairments, spectrum, restructuring costs and such other items as determined by the Board and management. Refer to Full year results and operations review – guidance vs reported results reconciliation which details the adjustments made for the current and comparative period to reflect performance on the basis on which we provided guidance to the market for FY22 (set out in our ASX announcement titled "Financial results for the Full year ended 30 June 2022" lodged with the ASX on 11 August 2022).
In-year nbn headwind or nbn headwind	The net negative recurring EBITDA impact of the nbn on our business for the reporting period. See 'nbn impact on EBITDA' slide for details of the in-year nbn headwind
Net one-off nbn DA less net C2C or one-off nbn DA	Adjustments for net one-off nbn receipts which is defined as net nbn one-off Definitive Agreement receipts (consisting of PSAA, Infrastructure Ownership and Retraining) less nbn net cost to connect
Reported lease adjusted	'Reported lease adjusted' includes all mobile handset leases as operating expenses in FY21. FY21 adjusted to include \$194m of reported depreciation of mobile handsets right-of-use assets in EBITDA. No adjustment in FY22.
ROE	Calculated as Profit After Tax after Minority Interests (PATMI) as a percentage of equity
ROIC	Calculated as Net Operating Profit After Tax (NOPAT) as a percentage of total capital
Total income	Total income excluding finance income
Underlying earnings	NPAT excluding net one-off nbn receipts and guidance adjustments (as defined above). See 'Underlying earnings' slide for details
Underlying EBITDA	Underlying EBITDA excludes net one-off nbn DA receipts less nbn net C2C and guidance adjustments (as defined above). FY20/21 underlying EBITDA also included depreciation of mobile lease right-of-use assets.
Underlying EPS	Calculated as PATMI attributable to each share, excluding net one-off nbn receipts and guidance adjustments (as defined above).
Underlying ROIC	Calculated as NOPAT as a percentage of total capital, excluding net one-off nbn receipts and guidance adjustments (as defined above) less tax.

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Broadband and Telephony Services Over Cable Television Networks

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Organisation for Economic Co-operation and Development

07-Nov-2003

English - Or. English

**DIRECTORATE FOR SCIENCE, TECHNOLOGY AND INDUSTRY
COMMITTEE FOR INFORMATION, COMPUTER AND COMMUNICATIONS POLICY**

Working Party on Telecommunication and Information Services Policies

BROADBAND AND TELEPHONY SERVICES OVER CABLE TELEVISION NETWORKS

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FOREWORD

In June 2003 this report was presented to the Working Party on Telecommunications and Information Services Policy (TISP) and was recommended to be made public by the Committee for Information, Computer and Communications Policy (ICCP).

The report was prepared by Mr. Sam Paltridge of the OECD's Directorate for Science, Technology and Industry. It is published on the responsibility of the Secretary-General of the OECD.

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SUMMARY

Broadband Internet access is one of the first services where there has been a convergence between communications platforms built for different purposes. Networks originally built for cable television and circuit switched telephony can both provide broadband Internet access. Both platforms need to be appropriately upgraded but this is happening apace across many OECD countries.

Once upgraded, both platforms can also provide an “always-on” telephony service using the Internet protocol. The PSTN has always been able to provide telephony and cable networks could also do so if they replicated elements of the PSTN. However, to date, cable telephony has only been able to capture a relatively small proportion of the overall telephony market. At the same time, telecommunication carriers can use DSL to provide video services for the first time, over copper local loops, at an acceptable quality. Such services had previously only been in the domain of cable television networks.

All these possibilities have meant that, even during a period of relatively slow growth in communications, the overall market has continued to grow. Competition among different platform providers helped to increase broadband Internet access by 67% during 2002. There were just three million broadband access subscribers in the OECD at the end of 1999. By the end of 2002, this had grown to 56 million. This represents one of the fastest adoption rates for any new communications service. On the other hand, penetration and respective growth rates are very uneven across the OECD. Moreover, there are very wide differences in the level of basic service offered in different countries, of a type that has not previously existed with other services.

In Korea and Japan, residential baseline offers for broadband Internet access range from 4 Mbps to 8 Mbps. In most other countries, the baseline broadband offer, using cable or DSL, is between 250 kbps to 512 kbps. The baseline speed is largely determined by the amount of competition in any given market. In the United States, Time Warner offers residential cable modem service at 2 Mbps and a commercial service at between 2 to 4 Mbps.¹ In response, Verizon offers residential services from 760 Kbps and business services up to 7.1 Mbps.

Within Europe, the difference in performance levels on offer are also enormous and largely depend on how much competition incumbents face. Residential subscribers in Belgium have broadband access at 3 Mbps for DSL and 4 Mbps for cable modem service. That significantly exceeds the highest speeds available to business users in many other European countries.² While there have always been significant differences in penetration across the OECD for any communications service, the gaps were not great in terms of the capacity offered. The performance of DSL or cable modem service offered at 256 kbps is significantly different to a service offering 8 Mbps. At the same time, the leading countries are forging ahead with higher-speed access through technologies such as VDSL and fibre to the home. In Japan, residential fibre-to-the-home services are available at 100 Mbps, from a cable company, for USD 45 per month. Moreover, in Korea and Japan, roaming through a growing number Wireless-LAN “hot-spots” is being marketed as an extremely inexpensive option for fixed network broadband subscribers (*e.g.* less than USD 20 for unlimited monthly service).

The huge differences that have emerged, initially in terms of penetration but more recently in the level of service offered, warrant close attention from policy makers. Previous OECD reports have examined the roll out of DSL. This report examines the experience of cable networks in providing broadband Internet access and, where available, cable telephony. The primary objectives at the report are two-fold. The first is to benchmark some key indicators such as the take-up of various services over cable networks. The second is to briefly review the experience in each OECD country in respect to cable networks providing a competitive platform to the PSTN. One conclusion that can be drawn from this work is that the broadband markets in one-third of OECD countries are being held back where the cable networks are not providing independent competition with the PSTN. This is evident in the differences in level of service, pricing and take-up of service. In these cases, all options need to be considered to increase the level of competitive provision of broadband access including separating cable networks from incumbent PSTN operators. There may be cases where this is not necessary if these cable networks were developed in an open market (*i.e.* not under a monopoly or duopoly applying to the telecommunications market) or if sufficient competition is available via other means. Policy makers need to weigh the costs and benefits of each approach. This needs to occur on a case-by-case basis after an assessment of the overall level of competition in providing broadband access. The issue of incumbent telecommunication carrier ownership of cable networks continues to be of interest to regulators in a number of countries as they assess the take-up of broadband access. This is evident from the recent decision by the European Commission in the Telia-Sonera merger case, which was only approved subject to Telia's divestment of its cable network in Sweden.

CABLE TELEVISION NETWORK AVAILABILITY AND SUBSCRIBERS

The number of cable television subscribers in OECD countries reached 163 million at the end of 2001. This was up from 103 million subscribers in 1992. Cable television is one of the few platforms for communication where there are more subscribers outside the OECD area than within Member countries. This is a relatively recent occurrence. In 1992, cable subscribers in OECD countries represented 88% of the world's total number of subscribers. A decade later, in 2001, more than 50% of the world's cable subscribers were in non-member countries. China, India and, to a lesser extent, Russia, are responsible for most of these subscribers. By 2000, these countries collectively made up 77% of the cable subscribers outside the OECD area.

The best measure of the availability of cable television is the number of households passed by a cable network (Table 1). The availability of cable television ranges from the service not being offered in Greece to nearly 100% coverage in Belgium. While all data are not available, it can be said that cable television is available to more than half the households in OECD countries. The subject of this paper is the use of cable infrastructure to offer broadband Internet access and telephony rather than cable television. The development of cable television, itself, has a somewhat chequered history across the OECD, with some countries being far in advance of others. For the most part differences can be attributed to regulatory frameworks that have encouraged or tended to hold back the development of cable networks. Among the factors that could be considered as contributing to the different levels of penetration are whether public or private ownership existed, whether franchises were national or limited in geographic scope, whether media ownership or structural separation applied and whether regulation was weighted in favour of one medium over another and so forth. An example of the latter phenomenon might be "anti-siphoning" rules that ensure that some content must be shown on free-to-air television, making it harder for cable companies to win exclusive rights for the most popular content. These questions go beyond the scope of this paper although they are arguably relevant to a discussion of the availability of cable networks. This paper focuses on the take-up of broadband access and telephony where they are available. In other words, the major focus is on the performance of operators in terms of households passed by cable networks.

In recent years cable communications companies have recorded among the highest rates of revenue growth in the communications and information industries segment. Data from the United States Census Bureau show that the cable industry grew by 64% between 1997 and 2001 (Table 2). This compared with 102% for Information Services and Data Processing, 41% for Telecommunications, 31% for publishing, 24% for Motion Picture and Sound Recording and 17% for Television and Radio. Internet access, including dial-up and broadband access, is included under three of these categories – cable television, telecommunications providers and information services.

The FCC also reports data on revenue trends across telecommunications and cable television. Revenue trends in segments of the telecommunications industry are available to end 2002 (Table 3). These data indicate that wireless services and Internet access have been two of the major growth areas in the sector. In its annual report on competition in video markets the FCC also reports data of cable television revenue drawn from industry sources. Between 2000 and 2001, cable industry revenues increased by around 15.9% in the United States.³ These data also indicate strong growth in the provision of cable television and broadband Internet access. Estimates available to the FCC indicate that the provision of high-speed Internet grew from USD 198 million in 1998 to USD 5.6 billion in 2002.⁴

In terms of telecommunications, firms reporting to the FCC can categorise revenue they earn from DSL under Internet access or local private line service. ISPs that are independent of firms licensed by the FCC do not report data under this process. Although all data for 2002 are not yet available, it is interesting to note the pattern of growth and shifts between traditional categories that have been occurring over the last decade. The two areas with strongest growth are wireless service and other revenue which includes Internet access. Substitution between services is readily evident (*e.g.* wireless for fixed, DSL for second lines). While the category which includes Internet access is not yet available for 2002, the growth of DSL would suggest it is likely to increase (subject to being reported under this category). One conclusion from the data available, at the time of writing, is that the total telecommunications and cable industry revenue was, in all likelihood, still growing throughout 2002. For both industry segments, broadband Internet access is an important new driver of growth. The incumbent telecommunication carriers that have reacted first to these changes and adopted broadband access as critical to the future of their enterprises, such as KT in Korea, are already reaping financial benefits. Cable companies are also benefiting from strong revenue growth due to increasing broadband access.

Table 1. Cable television in the OECD area

	Number of cable television subscribers					Percentage of homes passed by a cable television network			Number of subscribers to telephony services provided by cable networks	
	1997 (13)	1998 (13)	1999 (13)	2000	2001	1999 (13)	2000	2001	2000	2001
Australia	575 000	614 000	677 000	684 000 ¹	760 000 ¹	..	19	19	..	..
Austria	1 065 000	1 100 000	1 100 000	1 200 000	1 250 000	53	53	53	..	142 600
Belgium	3 686 001	3 725 191	3 751 795	3 788 650	3 814 949	100	100	100	152 539	209 378
Canada ²	7 946 000	7 994 000	8 041 000	7 977 000	7 868 000	90	90	90	..	..
Czech Rep.	512 076	792 372	923 837	955 000 ³	965 000 ⁴	60	61	62	0	0
Denmark	1 000 000	1 050 000	1 350 000	1 040 598	1 078 483	70	71	71	0	0
Finland	875 000	906 000	933 000	950 000	1 000 000	63	58	59	0	0
France	2 136 000	2 392 000	2 662 000	3 055 400	3 375 200	32	34.5	34.5	40 300	62 000
Germany	18 020 000	18 650 000	20 400 000	21 100 000	21 800 000	86	81.9	82.6	20 000 ¹⁴	20 000 ¹⁴
Greece	0	0	0	0	0	0	0	0	0	0
Hungary	1 490 000	1 520 000	1 543 000	1 458 000	1 560 000 ⁷	66	53.8	56.7	0	0
Iceland	0	0	0	4 000	5 000	..	33	35	..	..
Ireland	430 000	535 000	596 000	630 000	613 000	50	76.1	77.7	..	..
Italy	44 200	61 000	82 000	50 000 ⁹	120 000 ¹⁰	5	0	1.48	4 200	40 300
Japan	6 719 744	7 936 093	9 470 882	10 480 000 ⁵	13 030 000 ⁵	20	21.8	27.2	..	..
Korea	6 678 300	6 423 538	7 041 993	8 402 584	10 831 666	48	56.2	71	..	..
Luxembourg	..	..	115 000	120 000	121 000	73	75	75	0	0
Mexico	1 383 047	1 614 887	1 959 381	2 281 679	2 514 150	32	32	32	0	0
Netherlands	5 800 000	5 900 000	6 000 000	6 200 000 ³	6 200 000 ⁴	94	94	94	..	..
New Zealand	..	6 100	16 723	21 000	26 000 ¹¹	6.7	7.3	9.7	..	..
Norway	705 125	774 607	788 722	824 116	840 097	47	47	47	..	..
Poland	3 037 000	3 172 000	3 636 000	3 590 000	4 300 000	..	..	30	..	22 350
Portugal	383 000	596 000	760 000	925 000	1 119 000	47	54	60	1 550	58 427
Slovak Rep.	550 000	616 000	650 000	726 000	724 000	36.6	40.6	35.2	..	..

Table 1. Cable television in the OECD area
(Cont'd)

	Number of cable television subscribers					Percentage of homes passed by a cable television network			Number of subscribers to telephony services provided by cable networks	
	1997 (13)	1998 (13)	1999 (13)	2000	2001	1999 (13)	2000	2001	2000	2001
Spain	4 500	12 500	156 000	341 000	553 179	8	18.8	28.5	312 134	661 485
Sweden	1 930 000	2 000 000	2 000 000	2 155 800	2 110 000	65	65	65	..	..
Switzerland	2 516 803	2 550 291	2 585 814	2 628 639	2 684 016	73	73.5	75	0	0
Turkey	511 706	611 057	750 290	884 574	908 662	..	6.15	13	..	..
UK	1 900 000	2 374 000	2 826 000	3 562 000	3 618 000	51	50	50	5 298 000	5 408 000
USA	64 900 000	66 100 000	66 700 000	68 500 000	69 000 000 ¹²	96	97	97.1	900 000	1 500 000
OECD	134 798 502	140 026 546	147 516 437	154 535 040	162 780 402	55.7	56.2	58.7	6 688 423	8 062 510

Notes:

1. Approximations. 2. From Statistics Canada. 3. Data from ITU. 4. Czech data updated to that shown in the *Communications Outlook* 2003. 5. Number of households. 6. Percentage of total number of households as of 2000. 7. Estimate. Statistical data for this year have not been compiled. 8. At the end of 2001 Fastweb was available in 36 000 buildings, corresponding to 319 000 or 1.4% of Italian households. 9. Approximation for Stream TV. 10. About 80 000 (Stream TV). In addition, the 40 000 subscribers (4th quarter 2001) to Fastweb, the main Italian fibre-to-the home provider, can access a selection of the state-owned TV company RAI's channels, D+ (satellite TV operator) and Stream TV (satellite and cable TV operator). 11. For September 2001. 12. For June 2001. 13. Data from Chapter 6 of the *OECD Communications Outlook 2001* (Source: OECD, ITU, OBS.) 14. Less than 20 000.

**Table 2. Information sector services industry revenue in the United States,
USD millions**

	1997	1998	1999	2000	2001
Cable Television	45 389	52 469	60 059	68 110	74 631
Telecommunications	260 500	285 871	319 102	350 176	367 173
Television and Radio	40 425	44 089	47 593	52 992	47 380
Motion Picture and Sound Recording	55 925	60 592	65 051	68 160	69 366
Publishing	179 035	202 876	220 631	235 193	235 073
Information Services and Data Processing Services	41 937	48 396	61 958	78 653	84 680
Cable Television	100	116	132	150	164
Telecommunications	100	110	122	134	141
Television and Radio	100	109	118	131	117
Motion Picture and Sound Recording	100	108	116	122	124
Publishing	100	113	123	131	131
Information Services and Data Processing Services	100	115	148	188	202

Source: United States Census Bureau – NAICS 51 (North American Industry Classification System).

Cable Telephony

Although complete data are not yet available, there were in excess of 9.2 million cable telephony subscribers at the end of 2002. The available data for 2001 and 2000 were 8 million and 6.7 million respectively. In 2001, the number of lines provided by cable telephony was 1.3% of the total number of fixed lines in OECD countries. This would not have significantly increased in 2002.

Although very small in terms of the total market, the impact can be significant in individual markets. In the United Kingdom, for example, some 15.1% of all telephony lines were provided by cable companies. This number takes on added significance in that cable networks only pass around half the total number of households in the United Kingdom. Cable companies in Australia supplied by 5.6% of all lines at the end of 2001. In other markets the overall share of cable telephony is lower but some individual companies are recording very high take-up rates in terms of households passed. It is the latter phenomenon that is providing competitive pressure on telecommunication carriers as they need to respond in those markets where cable telephony service is available.

For the future, the cable telephony market is likely to expand but through two different technological platforms. The majority of cable telephony, to date, has been supplied by cable companies employing copper local loops for business and residential premises alongside their coaxial cable. In the future, it is likely that voice over the internet protocol (VoIP) will come increasingly to the fore. One reason for this is that the number of cable modem connections is growing much faster than the number of cable telephony connections using copper local loops. These cable modem connections will provide the platform for the introduction of VoIP.

In 2003, some cable companies are already offering VoIP and most others are undertaking trials or expect to introduce the service in the near future. VoIP has the potential to grow very quickly if pricing is attractive to users. Consider, for example, that “Yahoo BB!”, a Japanese broadband access provider using DSL, signed up 2 million customers in less than 12 months following the launch of commercial service. In the United States VoIP for broadband users ranges from “free” for broadband-to-broadband connections to USD 39.99 for unlimited domestic (and calls to Canada) terminating on a standard telephone line.⁵

Table 3. Telecommunications revenue in the United States
USD millions

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Local	91 835	95 595	99 011	103 792	109 273	107 634	112 268	118 725	127 103	132 666	128 030
Long distance	61 378	64 393	70 466	76 447	86 896	89 570	95 992	98 414	101 407	93 702	82 184
Wireless	7 378	10 179	14 179	18 627	25 900	33 030	37 032	50 152	63 280	74 596	83 592
Other (including Internet access)	6 944	7 581	8 324	9 071	10 474	25 634	26 408	33 144	42 261	48 036	na
Total reported telecommunications revenue	160 774	172 860	183 214	199 147	222 256	256 801	272 801	301 648	335 023	349 836	na
Local (1992=100)	100	104	108	113	119	117	122	129	138	144	139
Long distance (1992=100)	100	105	115	125	142	146	156	160	165	153	134
Wireless (1992=100)	100	138	192	252	351	448	502	680	858	1 011	1 133
Other including Internet access (1992=100)	100	109	120	131	151	369	380	477	609	692	na

Note: There is a change in the series for "other" in 1997.

Source: OECD, based on FCC data.

The US National Cable and Telecommunications Association (NTCA) believes that with the continued improvements in VoIP, cable-delivered telephone service could evolve into a telecommunications “after thought” of consumers, rather than a separate, independent service. The first signs of this are already evident in the pricing of firms such as “YahooBB!” and Vonage.

Cable Modem Subscribers

The number of cable modem subscribers in the OECD area reached 23 million at the end of 2002 (Table 4). This compared to 30 million DSL subscribers at the same date. The overall number of broadband subscribers in OECD countries was 56 million. This meant that cable modems made up 41% of the overall broadband market, compared with 54% for DSL. Other technologies represented around 3%. Although cable modem services had an early lead on DSL, the latter overtook the number of cable modem services at the end of 2001. By 2002, the growth rate for DSL was appreciably higher than for cable modems. In that year, the DSL market grew by 83% compared to 53% for cable modem services.

In the final quarter of 2002, the pace of DSL increased such that across the OECD the number of DSL subscribers was growing twice as fast as cable (Table 5). In the EU area, DSL was growing about five times faster than cable in the final quarter of 2002. By way of contrast, cable modem service was growing faster than DSL in Austria and the United States.

One reason why DSL has overtaken cable modem service is that, in many countries, it is much more widely available. A second factor is that incumbent telecommunication carriers own numerous cable networks. This has had an increasingly negative impact on cable modem growth. That being said, in 2002, the number of cable modem subscribers exceeded that for DSL in 12 OECD countries. The reverse was true in 17 countries, although the difference is negligible in Australia, Hungary and Ireland. In Greece, neither service was available at the end of 2002.

The countries where cable networks significantly outperform DSL, in order of relative magnitude, are the Netherlands, Austria, the United States, Portugal and Canada. Generally this is because of very strong cable performance, but in the case of Portugal there is a very low DSL penetration. On the other hand, Canada’s telecommunication carriers reacted to cable modem growth several years ago and have among the highest rates of take-up for DSL. Where the incumbent telecommunication carriers are outperformed by cable in other markets it would be expected that they will also have to significantly lift their performance if they wish to remain competitive.

Table 4. Broadband access subscribers in the OECD, 2002

	DSL subscribers	Cable modem subscribers	Other	DSL per 100 inhabitants	Cable per 100 inhabitants	Other per 100 inhabitants	Total per 100 inhabitants
Australia	177 900	173 200	12 400	0.9	0.9	0.1	1.9
Austria	179 500	327 600		2.2	4.0	0.0	6.2
Belgium	517 000	326 181	25 813	5.0	3.2	0.3	8.5
Canada	1 642 554	2 008 566		5.3	6.5	0.0	11.7
Czech Rep.	100	16 800		0.0	0.2	0.0	0.2
Denmark	307 055	133 003	5 784	5.7	2.5	0.1	8.3
Finland	229 000	54 000	9 200	4.4	1.0	0.2	5.6
France	1 409 000	282 992		2.4	0.5	0.0	2.9
Germany	3 195 000	56 845	70 000	3.9	0.1	0.1	4.0
Greece	72	0		0.0	0.0	0.0	0.0
Hungary	3 3951	31 819		0.3	0.3	0.0	0.6
Iceland	2 3785	0	1 600	8.3	0.0	0.6	8.9
Ireland	3 300	2 300		0.1	0.1	0.0	0.1
Italy	850 000	0	175 000	1.5	0.0	0.3	1.8
Japan	5 645 728	1 954 000	206 189	4.4	1.5	0.2	6.1
Korea	6 386 646	3 701 708	39 959	13.5	7.8	0.1	21.4
Luxembourg	4 430	70		1.0	0.0	0.0	1.0
Mexico	66 566	150 000		0.1	0.2	0.0	0.2
Netherlands	354 746	795 921	200	2.2	5.0	0.0	7.2
New Zealand	54 000	5 563		1.4	0.1	0.0	1.5
Norway	147 000	49 200	6 379	3.3	1.1	0.1	4.5
Poland	14 000	33 900		0.0	0.1	0.0	0.1
Portugal	52 005	207 486		0.5	2.1	0.0	2.6
Slovak Rep.	0	420		0.0	0.0	0.0	0.0
Spain	957 204	252 765		2.4	0.6	0.0	3.0
Sweden	424 000	153 700	142 500	4.8	1.7	1.6	8.1
Switzerland	195 220	260 000		2.7	3.6	0.0	6.3
Turkey	2 967	17 850		0.0	0.0	0.0	0.0
UK	590 000	779 319	2 000	1.0	1.3	0.0	2.3
USA	6 595 532	11 300 000	1 928 152	2.3	4.0	0.7	6.96
OECD	30 058 261	23 075 208	2 625 176	2.6	2.0	0.2	4.9
EU	9 072 312	3 372 182	430 497	2.4	0.9	0.1	3.4

Note: Subscribers below 250 kbps are excluded where possible as in the case of Denmark. It is not yet possible to exclude subscribers using sub-broadband speeds in the relatively small number of other countries where such offers are in place. These countries are shown in Table 8. Other for the United States is June 2002.

Source: OECD.

Table 5: Broadband subscribers: fourth quarter growth, 2002

	DSL additions per 100 inhabitants	Cable modem additions per 100 inhabitants	Other additions per 100 inhabitants	Total additions per 100 inhabitants
Iceland	1.92	0.00	0.21	2.13
Finland	1.54	0.14	0.03	1.72
Switzerland	0.87	0.83	0.00	1.70
Japan	1.12	0.12	0.06	1.30
Belgium	0.74	0.40	0.01	1.15
Netherlands	0.65	0.34	0.00	0.99
France	0.89	0.06	0.00	0.95
Norway	0.79	0.12	0.00	0.91
Denmark	0.74	0.10	0.00	0.84
Austria	0.34	0.49	0.00	0.83
Sweden	0.58	0.20	0.00	0.79
Canada	0.58	0.19	0.00	0.77
Portugal	0.34	0.36	0.00	0.70
Korea	0.66	0.05	0.00	0.70
United Kingdom	0.30	0.30	0.00	0.61
Spain	0.52	0.08	0.00	0.60
United States	0.22	0.39	0.00	0.60
Germany	0.42	0.01	0.01	0.44
Italy	0.35	0.00	0.08	0.42
Australia	0.18	0.08	0.01	0.26
New Zealand	0.23	0.01	0.00	0.25
Hungary	0.07	0.06	0.00	0.13
Ireland	0.04	0.03	0.00	0.07
Czech Republic	0.00	0.05	0.00	0.05
Luxembourg	0.03	0.00	0.00	0.03
Poland	0.02	0.01	0.00	0.03
Mexico	0.02	0.01	0.00	0.03
Turkey	0.00	0.01	0.00	0.01
Greece	0.00	0.00	0.00	0.00
Slovak Republic	0.00	0.00	0.00	0.00
OECD	0.40	0.17	0.01	0.58
EU	0.50	0.12	0.01	0.63

Note: Canadian cable data included end November 2002 for three companies such that overall quarterly growth would have been slightly higher for Canada's cable sector. Growth under other is not available for the United States as latest data are June 2002.

Source: OECD.

CABLE TELEVISION OWNERSHIP

Incumbent telecommunication carriers have had an ongoing stake in the cable television industry throughout the 1990s. Their peak participation was in 1998 when one in every five cable television customers across the OECD subscribed to a system owned by an incumbent telecommunication carrier. This was up from around 15% in 1993. If the overall percentage of telecommunication carrier ownership of cable networks seems small, it is worth noting that, in 1998, some 70% of all subscribers to cable networks outside of Canada, Japan, Korea and the United States were customers of incumbent telecommunication carriers. In the EU area, some 59% of the cable market was owned by incumbent telecommunication carriers in 1998.

Some of the carriers that entered the market between 1993 and 1998 were Ameritech (now part of SBC), Bell South, Matav, Portugal Telecom, Siminn, Swisscom, Telstra, Telmex, Telecom Italia and Telecom New Zealand. Other incumbents, such as BT, France Telecom, Deutsche Telekom P&T Luxembourg, TDC, Telia, Telenor, Turk Telecom, had longer-standing ownership of cable networks systems. Sometimes this had resulted from a national plan developed in their capacity as State-owned carriers, with monopolies over the provision of communications infrastructure. In other cases, the carriers were simply awarded franchises for certain regions, with independent cable companies operating in other areas. In some cases, such as Ameritech and Bell South, it was the result of deregulation, which allowed carriers to compete against existing cable networks.

Following its peak, in 1998, there has been a gradual decline in the incumbent telecommunication carrier share of the cable market. In some cases, this was the result of regulatory intervention (*e.g.* divestiture at the time of a merger), and in others a separate sale of the cable network at the time of privatisation of the incumbent. There were also instances of incumbents simply changing their commercial strategy and selling off or discontinuing to build cable networks. An element in the latter phenomenon is that cable network ownership in home markets has not proved to be very financially rewarding, as a standalone business, for telecommunication carriers. As the telecommunication market evolves, with competition from multiple platforms, defensive plays in telephony may no longer justify a loss-making cable operation. One of the first incumbent telecommunication carriers to sell their cable network was in the Netherlands. When in 1997, KPN sold Casema to France Telecom. This sale was followed by BT, Eircom, Telmex, Swisscom selling their respective cable networks in the United Kingdom, Ireland, Mexico and Switzerland. In other cases, such as for Telecom New Zealand and Telecom Italia, fledgling cable networks were simply closed by those carriers. In the United States, all the incumbent local exchanges carriers bar one that entered the cable market following the 1996 Telecommunications Act, had withdrawn by 2002. The exception was Bell South which maintained a very small cable network. Moreover France Telecom and Deutsche Telekom began selling cable assets.

The major change in the proportion of cable networks owned by incumbents occurred in March 2003, when Deutsche Telekom sold its remaining cable networks. Following the sale Deutsche Telekom only had an equity position in one cable network in Germany. Deutsche Telekom's divestiture brought the total share of the cable market owned by telecommunication carriers down to a little over 5%. This number will fall further following the completion of the sale of TeliaSonera's cable network in Sweden. This is a requirement of the merger between of Telia and Sonera.

Even though the tide has turned on incumbent telecommunication carrier ownership of cable networks, they are still major players in just over one third of OECD countries. In April 2003, these countries were: Australia, Denmark, Finland, France, Hungary, Iceland, Luxembourg, Norway, Portugal, Sweden and Turkey. In Germany, the share of Deutsche Telekom is now very small, and in the United States, Bell South's market share is negligible.

In the one-third of countries with ongoing cable ownership by incumbent carriers, all are either the largest or second-largest players in the respective markets. In Australia, Denmark, Sweden and Portugal, the incumbents own the largest cable network. In Finland, Elisa and TeliaSonera both own cable networks, as does Matav in Hungary, Siminn in Iceland and Telenor in Norway. France Telecom, P&T Luxembourg and Turk Telekom own cable television networks as well as being the infrastructure provider for some other cable networks.

The impact of incumbent telecommunication carrier ownership of cable networks on the provision of cable telephony is very clear. For obvious reasons, cable networks owned by telecommunication carriers do not provide cable telephony. This service is, of course, already provided via the PSTN (Public Switched Telecommunication Network). By way of contrast, the same can not be said about the provision of Internet broadband access. Unlike an existing service, such as telephony with an established platform, telecommunication carriers that own cable networks can choose how to provide broadband access over cable modems, DSL, or both. Their performance in doing so can be benchmarked against independently owned cable companies. For policy makers, this assessment is necessary because, in those countries where telecommunication carriers own considerable shares of the cable sector, incumbents may own the only two available platforms that can readily provide broadband access. Regulated access, via tools such as unbundling and line sharing, can compensate to some extent but facilities competition is likely to lead to the best outcome. As one of the most important issues in communications is the development of broadband access, this analysis can help inform the question of why some countries are growing faster than others.

Take-up of Cable Services

To examine the performance of cable television networks, three indicators have been selected. These are cable modems, cable television and cable telephony. Data were collected for more than 50 cable television networks across the OECD, including those owned by incumbent telecommunication carriers and independently owned networks. Any networks owned by incumbents outside their "home country" were treated as independently owned networks. The indicator chosen to weight performance was the number of households passed by cable networks.

Cable Telephony

As noted it was not expected that there would be any cable telephony provided by incumbent telecommunication carriers and this, indeed, proved to be the case. It did, however, highlight those markets in which cable telephony is developing apace and those where independent cable companies are yet to introduce such a service. The companies with the highest take-up of cable telephony are Telewest and NTL in the United Kingdom. The other companies with a take-up rate higher than 20% of households passed are Optus in Australia, ONO Communications in Spain and Cabovisão in Portugal. Companies with between 10% and 20% are UPC (United Pan-Europe in Austria, RCN in the United States and Telenet in Belgium. While the leading performance of Telewest, NTL and Optus is commendable, it may also reflect the earlier date at which these companies were permitted to enter the telephony market. In the United Kingdom, cable companies entered the telephony market following the end of the telecommunications duopoly in 1992. In Australia, Optus entered the market as the second player during the country's telecommunications duopoly from 1992-97. Companies such as ONO in Spain and UPC (United Pan-Europe Communications) in

Austria have only been permitted to offer telephony since 1998, with Cabovisão offering telephony from 2000 onwards.

Cable Television

Telecommunication carrier ownership of cable networks raises the question of how these networks perform, relative to independently owned cable networks, in the take-up of cable television. Unlike cable telephony or even cable modems, there is nothing intrinsic to hold back a telecommunication carrier's performance in cable television service. On the other hand, as cable television is not a core business of telecommunication carriers, it is unlikely to be a priority in a number of respects. In addition, some carriers may enter or maintain their position in the cable television market to defend their telecommunications market rather than run cable networks with maximum efficiency.

As might be expected, independently owned cable television networks have a higher take-up rate than those owned by incumbent telecommunication carriers. However the difference is not large. Independent networks, on average, have a take-up rate of 56% whereas those owned by telecommunication carriers have a 50% take-up rate (Table 6). The independent companies with the leading take-up of cable television are in the Netherlands, Belgium and Switzerland. In respect to cable companies, in which telecommunication carriers are involved, the two best performers are in Germany. Both these companies were among the first in which Deutsche Telekom sold majority interests.

A number of networks have low take-up rates for cable television. Interestingly, some of the independent companies with the best take-up rates for cable telephony have a low take-up rate for cable television. The take-up rate for Optus is only 11% of households passed. In Spain, ONO has only managed to sign up 16.9% of households passed. In New Zealand, TelstraClear has a relatively low take-up rate as do both the cable companies in the United Kingdom.

In respect to cable networks owned by telecommunication carriers, a number have low take-up rates. In Iceland, only 15.7% of households take Siminn's cable television service. This may be because all available Icelandic channels are freely available and only foreign channels are subscription based. In Australia, Telstra also has a very low take-up on its cable television network, with just 19.2% of households passed subscribing to the service. Telstra attributes this, in part, to access and programme regulation. On the supply side, Telstra says that regulated third-party access to pay television channels has discouraged ongoing investment in cable networks. On the demand side, Telstra says the strict regulation of premium sporting events on pay television, in favour of their availability on commercial free-to-air television, has dampened consumer take-up. In France, NC Numericable, which uses France Telecom's cable network to deliver service, also has a relatively low take-up rate.

One additional factor needs to be taken into account in the take-up rate for some companies. In a small number of cases, cable companies serve customers in the same area. This occurs in Australia, Portugal and a small number of areas in the United States. In the United States, RCN is a so-called, cable "over-builder" in some regions. In other words, RCN is a new entrant competing against an existing cable television provider. This explains why RCN has a lower take-up rate than most other cable companies in the United States.

Table 6. Selected cable networks in the OECD, 2002

Country	Company (shaded companies are incumbent telecommunicati on carriers or part owned by incumbents in home markets)	Cable modem subscribers as proportion of households passed (%)	Cable television subscribers as proportion of households passed (%)	Cable telephony subscribers as proportion of households passed (%)	Households passed by CATV networks	Cable modem subscribers	Cable television subscribers	Cable telephony subscribers
Canada	Shaw	26.5	68.5	0.0	3 073 158	812 964	2 105 113	0
Canada	Rogers	20.6	74.1	0.0	3 103 200	639 400	2 300 000	0
Austria	UPC	19.2	54.4	16.2	923 300	177 600	502 200	150 000
GCI	United States	18.4	69.1	8.6	196 927	36 200	136 055	17 000
United States	Cablevision	17.6	67.8	0.3	4 369 385	771 000	2 963 215	12 240
Belgium	Telenet	16.9	87.9	11.9	1 775 733	300 000	1 561 353	212 000
United States	RCN	16.5	26.5	16.0	1 610 578	265 195	427 329	258 103
Belgium	UPC	15.7	85.0	0.0	153 500	24 100	130 500	0
Korea	Thrunet	15.7	0.0	0.0	8 300 000	1 301 620		0
Sweden	UPC	14.6	64.0	0.0	421 600	61 700	269 900	0
United States	Cox Communications	13.8	61.5	7.0	10 210 091	1 407 950	6 280 849	718 420
Canada	Cogeco	13.6	60.2	0.0	1 386 000	188 096	834 855	0
United States	Time Warner Cable	13.6	58.9	0.0	18 500 000	2 509 000	10 900 000	
Denmark	TeliaSonera	12.9	29.8	0.0	630 000	81 000	188 000	0
Netherlands	UPC	11.8	90.4	6.6	2 580 300	303 600	2 332 600	170 000
Netherlands	Essent Insight	10.9	96.0	0.0	1 737 717	190 000	1 669 056	
United States	Communicaions	10.9	57.1	1.3	2 436 400	266 100	1 391 500	30 600
United States	Charter	9.5	55.2	0.0	11 925 000	1 138 100	6 578 800	
Finland	HTV	9.4	74.1	0.0	320 000	30 000	23 7000	
United States	Comcast	9.2	54.4	3.7	39 150 000	3 620 000	2 130 5000	1 438 000
Netherlands	Casema	9.1	91.1	1.4	145 8000	132 265	132 8000	19 700
Japan	J-Com	8.7	24.5	6.0	5 810 400	504 500	142 2000	349 900
Belgium	Integan	7.9	72.8	0.0	287 541	22 853	20 9318	

Table 6: Selected cable networks in the OECD, 2002
(cont'd)

Country	Company (shaded companies are incumbent telecommunicati on carriers or part owned by incumbents in home markets)	Cable modem subscribers as proportion of households passed (%)	Cable television subscribers as proportion of households passed (%)	Cable telephony subscribers as proportion of households passed (%)	Households passed by CATV networks	Cable modem subscribers	Cable television subscribers	Cable telephony subscribers
Portugal	Cabovisão	7.6	29.9	20.2	73 5122	56 051	219 944	148 284
United States	Mediacom	7.0	58.3	0.0	2 729 412	191 000	1 592 000	
Spain	ONO	6.7	16.9	25.5	1 760 744	117 305	296 956	448 926
Norway	UPC	6.5	69.8	5.0	481 700	31 200	336 400	24 200
UK	NTL	6.2	24.5	28.7	8 404 100	517 100	2 055 300	2 411 500
Switzerland	Cablecom	6.1	81.2	0.0	1 909 400	117 400	1 549 700	
Portugal	Telecom Portugal	5.86	42.55	0	2 390 000	140 000	1 017 000	0
UK	Telewest	5.4	26.4	42.5	4 895 956	262 219	1 293 811	2 081 144
France	Noos	5.2	35.0	0.1	2 945 643	152 166	1 031 520	1 985
Finland	TeliaSonera	4.00	59.20	0	250 000	10 000	148 000	0
Poland	Aster City	3.8	53.3	0.0	525 000	20 000	280 000	
Australia	Optus	3.8	11.1	28.2	2 250 000	85 000	250 000	635 499
France	France Telecom	3.71	54.13	0	1 545 542	57 405	836 562	0
New Zealand	TelstraClear	3.6	22.6	0.0	154 700	5 563	35 000	
Denmark	TDC	3.20	70.80	0	1 250 000	40 000	885 000	0
Norway	Telenor (Avidi)	3.02	68.49	0	53 0000	16 000	363 000	0
Australia	Telstra	3.00	19.20	0	250 0000	75 000	480 000	0
Hungary	UPC	2.9	72.1	7.5	952 800	27 900	686 900	71 400
Germany	UPC Primacom	2.71	66.02	0	1 977 958	53 545	1 305 769	0
Sweden	TeliaSonera	2.67	51.67	0	2 700 000	72 000	1 395 000	0
Czech Republic	UPC	2.3	43.5	0.5	678 800	15 300	295 400	3 100
Mexico	UPC (Telecable)	1.7	27.1	0.0	298 100	5 100	80 700	
France	NC Numericable	1.53	32.65	0	2 299 994	35 260	750 843	0
France	UPC	1.5	34.1	4.1	1 350 200	20 400	459 800	55 700

Table 6: Selected cable networks in the OECD, 2002
(cont'd)

Country	Company (shaded companies are incumbent telecommunicati on carriers or part owned by incumbents in home markets)	Cable modem subscribers as proportion of households passed (%)	Cable television subscribers as proportion of households passed (%)	Cable telephony subscribers as proportion of households passed (%)	Households passed by CATV networks	Cable modem subscribers	Cable television subscribers	Cable telephony subscribers
Turkey	Turk Telekom	0.94	48.14	0	1 900 000	17 850	914 700	0
Poland	UPC (Poland)	0.7	53.2	0.0	1 869 000	13 900	994 900	0
Germany	UPC ewt/tss	0.49	84.90	0.01	678 900	3 300	576 400	100
Ireland	NTL (Ireland)	0.3	77.5	1.3	474 900	1 500	368 000	6 400
Germany	Kábel Hessen	0.02	71.89	0	1 800 000	400	1 294 000	0
Slovak Republic	UPC (Slovak Rep.)	0.0	78.1	0.0	381 000	0	297 400	0
Iceland	Siminn	0.00	15.71	0	35 000	0	5 500	0
Total of Above					172 333 900	16 939 807	8 6591 748	9 264 201
Average for Independent Cable		10.7	56.5					
Average for Telecommunication Carrier Cable		2.6	50.2					

Note: Shaded companies indicate that they are owned, or part owned, by an incumbent telecommunication carrier operating in the same country. Shaded rows indicate equity interest or infrastructure ownership during 2002. Average for cable television take up for independent companies adjusted to include Korean data.

Source: OECD.

In Australia, Telstra and Optus have an 80% overlap of their cable networks. Even then, the combined take-up rate for cable television is very low compared to other countries. In Portugal, cable networks also compete in the same area. There is a much higher take-up rate for cable television in Portugal than Australia. At the same time, Portugal Telecom and Cabovisão's take-up rates are relatively low in comparison with many companies. In both Australia and Portugal, competition between cable telephony and the PSTN has developed apace but the overall take-up of cable television is lower. To the extent that the incumbent telecommunication carrier is in the cable market in these two countries, as a defensive play in respect to telecommunications, this may be a factor in why there is a lower take-up of cable television. This can be the result, for example, if the incumbent carrier was in the cable market primarily to defend their telecommunications revenue rather than to develop cable television. In this situation, the objective may be to slow growth of the competitor in adjacent markets rather than to necessarily maximise the incumbent telecommunication carrier's delivery of cable television. On the other hand, as Telstra notes, the attractiveness of cable television to consumers can be influenced by regulation that requires some of the most popular content to be shown on free-to-air television. The Australian Government indicated in August 2003 that the so-called "anti-siphoning laws" may need refining.⁶

Cable Modems

Cable companies in Canada have attained the leading take-up of cable modems, in terms of homes passed. Shaw Communications provides cable modem service to just over one in every four households passed by their network. Rogers Communications has connected one in every five homes. At the end of 2002, these two companies were the only cable operators in the OECD to have a take up rate greater than 20% of all households passed. The only broadband access provider with a higher take-up rate is Korea Telecom. At the end of 2002, KT had connected the equivalent of one in every three Korean households using DSL. Hanaro Telecom, using a combination of cable modems and DSL has a performance similar to the Canadian cable companies in terms of take-up.

The cable companies with the next best performance are UPC in Austria as well as GCI and Cablevision in the United States. Telenet and UPC in Belgium also have relatively high take-up rates. The striking feature of all the cable companies with leading performance is that they are in markets where there is strong competition between cable and DSL. They are also all independently owned cable companies.

The best performing cable network that is owned by a telecommunication carrier is Portugal Telecom. However that company's performance presents a striking contrast to independently owned networks. Just over one in 20 households passed by Portugal Telecom's network takes cable modem service. Portugal Telecom's performance is followed by TeliaSonera in Finland and France Telecom. However, at this rate the take-up is very low, with TDC, Telenor and Telstra recording just one cable modem subscriber for every 33 households passed.

The ownership of cable television networks by incumbent telecommunication carriers has had quantifiable impacts on the development of broadband access. The average take-up rate for cable modems on networks owned by telecommunication carriers is just 2.6%. By way of contrast, the average for independently owned cable networks is 10.7%. In other words, if their home is passed by an independently owned cable company, users are four times more likely to take cable modem service.

The take-up rate for cable modem service on cable networks operated by telecommunication carriers is very poor relative to independently owned networks. In some cases this is because telecommunication carriers prefer to market DSL but this is not always the case. Telecom Portugal, for example, has many more cable modem subscribers than DSL subscribers. Telstra has around the same number of cable modem and DSL subscribers. This is not, however, the point. Where incumbent carriers have a preference for DSL, this translates into the cable network being severely under-utilised as a platform for providing broadband

Internet access. Moreover in the absence of a competitive platform or mechanisms that are working to efficiently open up local networks (*e.g.* unbundling, line sharing), the available evidence shows that incumbents develop DSL at a slower pace in those areas. This is due to a lack of competition from independently owned cable networks.

Where independently owned infrastructure or unbundling is at work, incumbents owning cable networks will work harder in those regions. Driven by unbundling and competition in some regions from independent infrastructure, TDC and TeliaSonera both had take-up rates of around one in ten homes for DSL at the end of 2002. However, if their cable companies were independently owned, all the evidence suggests they would also have a take-up rate of at least that magnitude. In Denmark, where TeliaSonera is not the incumbent, it had 12.8% take-up rate in 2002. In Sweden, at the same time, UPC had a take-up rate of 14.6%.

If UPC Sweden's take-up rate was applied to an independently owned ComHem an additional 323 000 modem users would have been in place. If TeliaSonera's Danish take-up rate was applied to TDC an additional 120 000 subscribers would have had cable modem service. The overall gains would, of course, have been higher because TeliaSonera and TDC would have had to compete more vigorously with DSL in those areas where they own both available platforms. Accordingly, the point is not that incumbents may prefer one platform to another but rather that a readily available platform is severely under-utilised.

Finally, the evidence suggests that any proposal to structurally separate cable networks along the lines that have been suggested for telecommunication networks, would not be advantageous. It is noticeable that where there is a separation of network facilities or a split between infrastructure and services, as for some networks in France and Germany, the take-up of cable modem service is very low. There may, of course, be other factors but it is interesting to note that France Telecom has double the take-up rate than NC Numericable, for which France Telecom provides the underlying network. On the other hand, the independently owned Noos, using its own network, has significantly outperformed both France Telecom and NC Numericable. It should be noted that the original structural separation was put in place for cable television provision at a time when services such as cable telephony or broadband Internet access were not envisaged.

Countering the foregoing trend is the fact that UPC France, which also owns its own network, has a very low take-up rate compared to that company's performance in many other markets. Notwithstanding this experience, independent cable networks almost uniformly outperform those of the incumbent. In Finland, for example, HTV has twice the cable modem penetration of Elisa or TeliaSonera. In Australia, Denmark, Hungary, Norway, Portugal and Sweden the same is also true. Although they significantly trail countries with wholly independent cable networks, the independent networks in these countries tend to boost performance. A comparison by country shows Korea, Canada and Austria as clear leaders (Table 7). Of the countries in which telecommunication incumbents own cable networks, Denmark performs best, followed by Australia and Portugal. In all these later three countries, there is an element of competition in the same region by cable companies that gives them a slight performance edge over countries where the incumbent owns both available platforms. These differences are discussed further in the individual country reviews.

The range of broadband access capacity available across different countries is shown in Table 8. The most notable feature is that the level of service is greater in those countries where independent cable companies compete with telecommunication carriers. The two outstanding countries are Japan and Korea where competition between cable and DSL has ensured the highest baseline levels of service. The impact is also noticeable in Belgium, Canada and the United States, where higher levels of basic service in the cable sector have meant telecommunication carriers also have to offer high levels of service. On the other hand, if the cable industry in a certain country offers a lower speed then the incumbent tends to match that offer.

The levels of service offered incumbents telecommunication carriers offering both cable and DSL are not designed to compete with each other. They generally have the same level of pricing and same level of service. Significantly, while high speeds are available in Italy (Fastweb) and Sweden (Bredbandsbolaget), their more limited geographical coverage may be the reason the incumbents have not yet responded with higher levels of DSL performance. One further observation is worth making. In countries where the telecommunication carrier does not own a cable television network but wishes to enter the video market in competition with cable television companies, the baseline DSL service is sometimes higher than cable modem. Deutsche Telekom has significantly lifted the baseline offer for its DSL service and is offering a range of video-on-demand services. That company's service is notably higher than German cable companies. A similar situation exists in Spain where Telefonica offers a high-level service on DSL than do the cable companies because the company wants to increase its share of the video services market. By way of contrast where incumbents own cable networks their DSL offers tend to be at lower baseline speeds.

Table 7. Cable modem take-up by country

	Cable modem subscribers as proportion of households passed by cable networks	Cable modem subscribers	Households passed by cable networks
Korea	33.6	3 701 708	11 013 520
Canada	19.0	2 008 566	10 597 814
Austria	18.9	326 181	1 730 000
Netherlands	11.9	776 000	6 537 000
United States	11.5	11 300 000	98 600 000
Japan	11.3	1 954 000	17 345 600
Switzerland	8.3	260 000	3 118 700
Belgium	7.7	326 181	4 237 800
Denmark	7.2	133 003	1 860 000
Spain	7.1	252 765	3 563 000
United Kingdom	6.2	779 319	12 540 000
Australia	6.2	173 200	2 800 000
Portugal	6.2	207 486	3 361 000
Sweden	4.8	153 700	3 206 000
Italy	4.7	71 000	1 500 000
Norway	4.7	47 700	1 017 000
Finland	3.8	54 000	1 415 997
New Zealand	3.6	5 563	154 700
France	3.1	275 000	8 768 144
Hungary	1.5	31 819	2 101 000
Poland	1.4	33 900	2 394 000
Turkey	0.9	17 850	1 900 000
Ireland	0.5	2 300	472 800
Germany	0.2	60 000	29 545 325
Luxembourg	0.0	75	159 300
Iceland	0.0	0	35 000

Note: Data not applicable or not available for Greece, Czech Republic, Mexico and Slovak Republic. Shaded countries are those in which incumbent telecommunication carriers were significant players in cable markets in 2002. Data for Italy are for Fastweb. Although Fastweb's subscribers do not use a cable modem to access the Internet, the company does offer video and telephony services.

Source: OECD.

Table 8. Range of broadband access speeds (downstream) in OECD countries

	DSL (incumbent or largest provider)				Cable			
	Baseline DSL service	Highest residential or commercial DSL service	Fibre to the home	Lowest Commercial DSL offer (non-broadband)	Baseline cable modem service	Highest commercial offer (downstream)	Cable company fibre to home	Lowest commercial cable modem offer (non-broadband)
Japan	8 000	12 000	100 000		8 000	12 000	100 000	
Korea	4 000	13 000				10 000		
Belgium	3 000	3 000			4 000	4 000		
Canada	960	3 000		128		1 500		128
United States	768	7 100			2 000	4 000		
Germany	768	1 536				1 024		
Norway	704	1 024			512	1 024		
Austria	512	2 048				1 024		
Spain	512	2 048			300	600		128
Sweden	512	2 048			640	1 024	100 000	
United Kingdom	512	2 048			600	1 000		150
France	512	2 048		128	512	512		
Ireland	512	1 024			600	600		128
Poland	512	1 024			512	512		
Portugal	512	1 024			512	1 024		
New Zealand	500	2 048		128	256	2 048		
Hungary	384	1 500			512	512		
Czech Republic	320	1 024		192		320		128
Iceland	256	6 000			0	0		
Denmark	256	2 048			256	2 048		
Slovak Rep.	256	2 048			0	0		
Turkey	256	2 048			256	512		64
Finland	256	2 048			525	525		
Mexico	256	2 048			256	764		64
Switzerland	256	2 048			256	2 048		128
Netherlands	256	1 536			312	2 048		
Australia	256	1 500			..	..
Italy	256	1 200			0	0	10 000	
Luxembourg	256	1 024			256	1 024		
Greece	0	0		0	0	0		

Note: Cable modem speeds are not specified in Australia by Telstra or Optus, with services being sold according to data downloaded. Verizon DSL and Road Runner Cable in New York are used for the United States. Verizon reportedly doubled the baseline speed in May 2003. Lowest DSL or cable modem offers exclude ISDN. Fibre to the home in Italy and Sweden are respectively Fastweb and Bredbandsbolaget. In Korea, Hanaro provides vDSL service at 20 Mbps.

Source: OECD.

REVIEW OF CABLE PERFORMANCE BY COUNTRY

Australia

Australia is one of two OECD countries where there is significant overlap between cable networks. The largest cable television network is owned by the incumbent telecommunication carrier (Telstra). Telstra's cable network passes 2.5 million households. The second largest cable network is owned by Optus a subsidiary of Singapore Telecom. The Optus cable network passes 2.25 million residences. The overlap between the two networks is around 80%, with the same areas being covered in Australia's three largest cities. As in other countries, cable may provide service in some areas where DSL is not available.⁷

The initial development of cable networks in Australia occurred during the duopoly in the provision of fixed network telecommunication infrastructure. The duopoly was from 1992 to mid-1997. Prior to that period there was no cable television, or "pay-television", in Australia. During the duopoly, Optus aimed to build a cable network with the goal of offering customers both television and telephony services. Telstra's entry into the cable market was primarily defensive in nature, with the aim of retaining telephony customers that might otherwise elect to take both cable and telephony services from Optus. The result of this situation was that cable networks construction occurred very rapidly with both players rolling out networks along the same streets of Australia's largest cities. The two companies also competed strongly to win the rights the most attractive sporting and entertainment content. On a relative basis, this led to some of the highest prices in the world being paid to the right's owners for such content.

By the end of the duopoly, faced with the incumbent's determination to build cable in most of the same areas, where the new entrant laid cable networks, as well as much higher than expected programming costs, Optus largely ceased to expand its cable network. For its part, having covered Australia's five largest cities, Telstra also ceased rolling out cable networks. Telstra says that regulated third-party access to pay television channels and regulation, aimed at ensuring some premium sporting events were shown on free-to-air broadcasters, discouraged ongoing investment to expand the cable network. As such, the reach of Australia's two largest cable television networks is about the same as it was in 1998. The end of the duopoly did, however, create opportunities for other players to launch cable networks in smaller cities. In Canberra, TransACT launched a trial cable television network in 1998 and commercial services were initiated in 2000. In 1997, Neighborhood Cable launched regional Australia's first cable network and has subsequently expanded to offer services in a number of regional cities in the State of Victoria. By April 2003, Neighbourhood cable passed 90 000 residences.⁸

The performance of cable networks in Australia is mixed. During the duopoly, cable networks were rolled out at a rapid pace but competition during the duopoly was largely focused on securing content rights and marketing cable television rather than telephony or the emerging market for high-speed Internet access. More recently, following the end of the duopoly, significant competition has developed for telephony in those regions covered by the Optus cable network. By June 2002, Optus had 635 000 telephony lines over its own facilities.⁹ This represented a 17% increase over 2001. The take-up of telephony, as a proportion of the number of homes passed by Optus, has been among the best in the world. In 2002, the number of telephony lines represented the equivalent of 28% of homes passed.¹⁰ Telewest, in the United Kingdom, is the only cable operator that has a significantly better take-up rate for telephony, in terms of homes passed.

The take-up rate for cable telephony, on the Optus network, provides evidence that facilities-based competition is at work in some regions of Australia. Although Australia's other cable networks are relatively small, they also report significant take-up rates for telephony in those areas where they compete against the incumbent. On the other hand, Optus has not been actively expanding its cable network into new areas. This means that users in some of Australia's largest cities are only passed by Telstra's cable network. They may not, therefore, have an alternative platform passing their business premise or residence which offers facilities-based competition – although regulated wholesale access and geographically averaged pricing provide users with the potential benefits of services-based competition. The original reason Optus ceased building new cable networks was that the economics became increasingly adverse as the incumbent built down the same streets and competed for the same content rights. More recently, however, it is much harder to justify entering a cable television market where Telstra has had the first-mover advantage. This situation applies in Australia's fourth and fifth largest cities. In smaller Australian cities the situation is more propitious as evidenced by the entry of TransACT and Neighborhood Cable. These companies were given a boost, in November 2002, by an agreement, brokered by ACCC (Australian Competition and Consumer Commission) that ensures that smaller networks have access to channels carried by Telstra's cable network.¹¹

In contrast to cable telephony the take-up rate for cable modems is relatively low in Australia. At the end of 2002, Optus had 85 000 cable modem subscribers and Telstra around 75 000. This represented a take-up rate of 3.8% for Optus and 3% for Telstra in terms of homes passed by their respective cable networks. This penetration is very low given that, by that time, it had been five years since the initial launch of cable modem services in Australia.

In September 1996, Telstra became the first operator in Australia, and one the first in the world, to launch cable modem services in a small number of Melbourne suburbs.¹² By May 1997, Telstra had made cable modem service available to more than one million business and residential premises.¹³ High-speed Internet access over cable networks should therefore have been up and running, but no competition was to emerge for several years. It wasn't until December 1999 that Optus began connecting its first cable modem customers.¹⁴ Telstra's DSL service was not launched until late in 2000.¹⁵ Telstra had planned to launch DSL in September 1999 but was delayed by twelve months, following the intervention of the ACCC. The regulator's intervention was aimed at ensuring that other ISPs could also launch service using Telstra's local loops. It has been suggested that this delay has contributed to Australia's position relative to other countries in terms of broadband penetration. On the other hand, Australia was one of the first countries in the world to launch cable modem service and, of the ten OECD countries which introduced DSL in 2000, Australia is placed at number eight. This suggests that starting dates are much less significant than level of competition in determining growth rates. The corollary being that the ACCC intervention, which is now facilitating faster uptake of DSL via independent ISPs, may have produced the best outcome.

Telstra's early launch of cable modems was undoubtedly due to the potential threat of competition both from Optus and the end of the telecommunications duopoly. Telstra's choice to launch cable modem service four years ahead of DSL is notable. As the incumbent, had Telstra launched DSL it would undoubtedly have had to make a wholesale offer available to competitors. On the other hand, by first launching cable Telstra could meet any potential competition that emerged from other facilities providers using cable or DSL.

The initial level and structure of pricing of Telstra's cable modem service, however, does not appear to have had much appeal to users. In the first three years of service Telstra only managed to attract around 15 000 users. One element of pricing that sets Australia and New Zealand apart from the rest of the OECD, is the lowest download limits associated with baseline pricing offers. In Australia, Telstra's download limit, before metered charging commences, has increased since competition emerged from competitors using regulated wholesale offers. In August 2003, a download limit of 500 Mbytes applied to Telstra's

baseline DSL and cable offers before metered pricing commenced. Previously the cap had been 250 Mbytes. Unmetered local calls for dial-up have been raised in Australia and New Zealand as a contributing factor in the slower growth of broadband take-up in these two countries. However, unmetered local calls for dial-up exist in a third of OECD countries, including those with the highest broadband penetration (*i.e.* Korea and Canada). What sets these and other countries apart is that their broadband pricing is unmetered, or has much higher download caps, making it more attractive for users to shift from unmetered dial-up. In fact, Australia's broadband growth has begun to increase as independent ISPs, using DSL via regulated access, have raised the data caps on baseline offers.

In the absence of initial pricing that was attractive to users, or for whatever other reason, Optus felt able to delay the launch of its service. Since that time, the value of an independently owned cable network is reflected in the superior growth of Optus cable modem service relative to Telstra's. On the other hand, Optus pricing has tended to follow the lead of Telstra, such as having a 550 Mbyte download limit on its baseline offer, rather than proving an alternative model. Should users of Optus exceed their monthly data allowance, they do not pay any excess usage charges. Instead, their data usage is limited to a maximum speed of a 28.8 kbps until the first day of the next calendar month. Pricing in the Australian market is however undergoing changes. Independent ISPs using regulated wholesale access are offering increasingly attractive offers to consumers. It is not uncommon for baseline DSL offers to include much higher download caps and some flat rates are emerging at the premium end of the market. One reason this is occurring in Australia and not New Zealand is that wholesale access pricing is unmetered. This allows greater flexibility for ISPs in Australia to offer a range of pricing options.

The most successful aspect of Australia's independently owned cable networks has been the take-up rate for cable telephony. The current problem for Australia is that independent cable networks pass less than a third of Australia's households. At the same time, the incumbent telecommunication carrier's cable network is under-utilised, with cable modem service being taken-up by only 3% of homes passed and users in some major cities not having a choice of platforms from different providers. The ACCC's action in introducing unbundling will increase competition in the DSL segment of the market. This is readily evident in the fact that DSL is now growing faster than cable modem service in Australia. The impact of regulated wholesale access for DSL, on the overall broadband market in Australia is another factor to be considered. In the first quarter of 2003, for the first time, independent ISPs sold more DSL subscriptions than Telstra's combined sales of retail DSL and cable modem subscriptions. If this trend continues, there will be increasing competitive pressure on Optus and Telstra in the overall broadband access market

Austria

Austria provides a leading example of the benefits of competition between independent cable television networks and DSL providers. Cable companies launched high speed Internet access services as early as 1997. UPC Telekabel Group, for example, launched an Internet access service in September 1997. A number of other cable companies, such as Liwest, commenced cable modem service in 1999. Stung into action, Telekom Austria launched its DSL service in November 1999 and, by 2002, could offer DSL service to more than 80% of the population.

The largest cable operator in Austria is UPC Telekabel. At the end of 2002, UPC Telekabel had one of the highest ratios of cable modem penetration of homes passed in the OECD, with a 19% take-up rate. UPC Telekabel offers cable telephony services to residential customers in Vienna, Graz and Klagenfurt. The company had 150 000 lines at end of 2002, representing a 16% take-up rate of homes passed.

Overall, Austria's cable market is performing very well with nearly twice as many cable modem subscribers as DSL subscribers. This performance has been achieved despite the fact that DSL is available to far more users in Austria than cable. One slightly disappointing aspect of the cable market is that nearly

all the cable telephony customers appear to be with UPC Telekabel, suggesting that other cable companies are not as active in this market segment.

Although Austria was one of the early leaders in the OECD in terms of broadband development, a number of other countries have recently overtaken its penetration. This is primarily because DSL has not kept pace with the growth of cable modem service in Austria. This led the regulator, RTR (Rundfunk and Telekom Regulierungs – GmbH), to announce in April 2003, that it was looking at ways to strengthen the development of all broadband Internet access technologies, including ADSL, cable modem, Wireless LAN and fibre to the home, with a particular focus on W-LAN.¹⁶

Belgium

Belgium has one of the highest penetrations of cable television in the OECD. Virtually every household or business in Belgium is passed by a cable television network. Belgium's cable companies have also been quick to introduce cable telephony and cable modem service.

In the four years following liberalisation of the telecommunications market in 1998, Belgium's cable operators added 209 000 telecommunication lines. In 2002, the pace of growth increased and by the end of that year the largest cable operator (Telenet) had 214 000 telephony lines. Telenet's take-up rate for cable telephony was the equivalent of 12% of all homes passed. Competition from cable companies is one of the reasons Belgacom, the incumbent telecommunication carrier, has substantially reduced prices for telephony since 1998.

It is, however, in the introduction of broadband access that Belgium cable companies have had the largest impact. As in the case of telephony, their importance is not just in terms of their own contribution to broadband development but also in their impact on the incumbent telecommunication carrier. It is not coincidental that Belgium has the highest number of households passed by cable and 98% availability of DSL. The impact of cable is also evident in other areas of DSL service. Belgacom was among the first telecommunication carriers to introduce self-install modems. Moreover, and currently of more importance, Belgacom has one of the highest baseline offers for DSL capacity. Belgacom's targeted downstream performance over the whole country is 3 Mbps for DSL. The reason why Belgacom's baseline is much higher than counterparts in many OECD countries is because cable companies are offering 4 Mbps downstream.

The take-up rate for Telenet's cable modem service is among the highest in the OECD, representing the equivalent of 17% of homes passed at the end of 2002.

Canada

Canada's cable industry has performed admirably in its contribution to the roll out of broadband access in Canada. Canadian cable companies were among the first to introduce cable modem service and their penetration significantly exceeds that for DSL. On the other hand, Canada's leading cable companies have not introduced cable telephony. One reason for this may be the fact that local calls are unmetered in Canada making it harder for competitors to enter the market. How much impact this has had on the strategy of the cable companies is difficult to determine. It has not, for example, stopped cable companies in the United States entering the market.

Although the largest Canadian cable companies have yet to launch cable telephony, one of the smallest operators has such a service in operation. Eastlink is a privately-owned company with operations in Nova Scotia, New Brunswick and Prince Edward Island. Eastlink is the sixth largest cable network in Canada and the largest private cable network in Canada with approximately 240 000 cable subscribers. The company launched local telephone service in 1999 with a bundled "triple play" strategy. The product

known as “Watch, Surf, and Talk” includes cable television, high-speed Internet access, and telephone service with up to ten calling features for USD 69 per month. A discount is available on the bundled product to obtain a price advantage (all three services together are about 20% less than they would be if taken separately). By the end of 2002, the company is reported to have signed up more than 10% of its cable subscribers for the telephone service, or around 25 000 subscribers. In some markets Eastlink reports a cable telephony penetration of 30% of cable customers, which is much higher than they had originally expected.¹⁷

An explanation for why Canadian cable companies are not yet offering telephony on a widespread basis, may be that they are waiting to enter the telephony market via VoIP over broadband as that technology matures. All the major cable companies in Canada have undertaken VoIP trials. However, they closed them around 2001-02 as they did not see the technology as viable at the time. No cable companies were offering VoIP by April 2003. All of the major cable companies have stated that they have no interest in circuit-switched telephony and are waiting for the cost level and performance of VoIP to improve. The Chairman and CEO of one of the leading companies stated, in February 2003, “The networks are, in terms of fibre to the feeder, node size, and everything really except the powering issue, telephony ready. We have prepared the network so that it could accommodate a telephone product.”¹⁸

The other likely reason that the major cable companies have not yet rolled out cable telephony is a question of their priorities. The two Canadian Direct-to-Home satellite operators have grown very rapidly in their five years of existence, offering an all digital service. The major cable companies have therefore focused on converting their large base of analogue customers to digital service. Moreover, the major cable companies have been very successful in developing their high speed Internet business, which continues to grow rapidly. They have consequently focused their time and resources in this area rather than on telephony.

It is certainly in respect to broadband that Canada’s cable companies have excelled. Canada’s two largest cable companies are Rogers Communications and Shaw Communications. Both companies have the highest take-up rates for cable modem services in terms of households passed. For Shaw, the equivalent of 26% of households passed took cable modem service in November 2002. For Rogers, the same metric was 21% at the end of 2002. The high availability of cable networks in Canada has undoubtedly contributed to their success in competing with telecommunication carriers. That competition has led to some of the lowest prices in the OECD for broadband and sub-broadband access. Broadband access from Shaw was priced at USD 29 per month in April 2002.

Canadian cable companies have also introduced a low-speed “always-on” cable modem service, at 128 kbps, aimed at drawing customers away from dial-up. In April 2002, the price of the latter service, from Shaw, was USD 20 per month as a stand-alone product, or USD 16 when bundled with cable television. In response, Bell Canada has introduced a similarly priced offer of USD 20 for DSL at 128 kbps. In the small number of telecommunication carriers in other countries offering “low speed always-on service”, at 128 kbps, these offers are all priced above USD 30 and at a premium compared with dial-up services in those countries. This is noted to make the point that in Canada, as a result of competition between cable and DSL providers, users could have a high-speed downstream connection at 960 Kbps for USD 30. In Canada’s case, the low-priced DSL and cable offers are aimed at competing with dial-up.

Czech Republic

The Czech Republic has a relatively high availability of cable television with some 62% of all households being passed at the end of 2001. The first commercial cable modem service was launched in 1999 and the largest cable network (UPC KabelNet) launched its cable service in 2000. By the close of

2002, UPC had 15 300 cable modem subscribers. This was the equivalent of a 2% take-up of households passed.¹⁹ UPC also offers cable telephony services and had 3 100 subscribers at the end of 2002.

The second and third largest cable networks in the Czech Republic agreed to merge in January 2003.²⁰ The two companies are Intercable and TES Media. The newly merged company offers cable television services to almost 300 000 subscribers and makes high-speed Internet services available to approximately 60 000 households. The total number of connectable households passed by the new company's network is more than 500 000. TES's core business is cable television, but it has two divisions to provide fixed wireless local loop and long-distance fibre data transportation services. At the close of 2002, TES Media had 1 500 high-speed-internet subscribers.

One reason for the relatively low development of cable modem services in the Czech Republic to date is that DSL service did not commence until early 2003. Just as telecommunication carriers need competition from cable companies, the reverse is equally the case. It is notable that Czech Telekom's DSL offers are designed to match the highest speed cable offer (*i.e.* 320 kbps) rather than offering superior performance levels for the first time in the Czech market.

Denmark

There are three major actors in the Danish cable television market. TDC, the incumbent telecommunication carrier, owns the largest cable television network in Denmark. At the end of 2002, TDC's network passed 1.25 million households, and the company had 885 000 cable television subscribers. The second largest cable network in Denmark is owned by TeliaSonera. TeliaSonera purchased the Stofa network in 1997. TeliaSonera services about 630 000 households, primarily in Greater Copenhagen and the larger provincial towns. In Greater Copenhagen, Telia covers 72% of all private households, rising to 99% of private households in central Copenhagen. At the close of 2002, TeliaSonera had 188 000 cable television subscribers. The third player in the Danish cable market is the FDA (Forenede Danske Antenneanlæg or the Danish Cable Television Association). Founded in 1983, the FDA organises about 375 local networks, representing around 311 000 households.²¹ FDA members own the network from the cable head-end to the home. In total, approximately 1.8 million households are passed by cable television networks in Denmark.

While there is no overlap between the networks of TDC and TeliaSonera, the members of the FDA have some discretion in choosing an upstream cable provider. The choice must be taken by the entire housing association rather than by individual members. This creates an element of competition for those households served by FDA systems. On the other hand, until the mid-1990s TDC was the only company allowed to build cable backbones across all the 270 local communities of Denmark. This has meant that it has tended to be only recently that a choice of backbone cable networks has been available to some FDA members.

There is no cable telephony offer in Denmark. FDA networks are not equipped to offer telephony and for those using TDC there is unlikely to be development of this service. TeliaSonera does not offer cable telephony and has instead focused on providing cable television and broadband Internet access. Some 13% of all households passed by TeliaSonera's cable network take cable modem service. By way of contrast, just 3% of the homes passed by TDC's cable network take cable modem service. This suggests an under-utilisation of TDC's cable network as an alternative platform for the provision of broadband access.

Overall the take-up of cable modems in Denmark is the best of any country where the incumbent telecommunication carrier is a significant player in the cable television market. However, this performance owes more to the independently owned TeliaStofa network than to TDC. That being said, the fact that FDA members can choose upstream suppliers has introduced an element of competition into the Danish market.

This means that of all the telecommunication carrier owned cable networks, TDC's network does provide a small degree of intra-company competition to DSL. One other element particular to the Danish situation is that the FDA believes that ownership of the network by its members has given them a higher degree of awareness of broadband. On the other hand, the low take-up rate on some cable networks may suggest that separation of different levels of network ownership has had mixed results.

As in the other Nordic countries, the ownership of cable television networks by incumbent telecommunication carriers has limited the available platforms for competition in Denmark. While Denmark's overall broadband performance is good in a number of areas, success has tended to result from the development of DSL services rather than cable. TeliaSonera has undoubtedly provided some competition but unbundling has arguably had a larger impact. On the positive side, Denmark can point to considerable achievements such as 95% DSL availability and among the highest broadband penetration rates in Europe. On the other hand, there are some limitations constraining growth in the current market. One example is that 2 Mbps is the highest speed new entrants offer over unbundled local loops. As such, without a more independent cable sector offering higher speeds there is less pressure on TDC, as compared to Belgacom for example, to offer higher-capacity broadband access in the Danish market.

Finland

Both the largest incumbent telecommunication carriers in Finland, Elisa and TeliaSonera, own cable television networks. Elisa's cable television network had 160 900 subscribers at the end of 2002. No data were reported by Elisa, in 2002, on cable modem subscribers, to their cable television networks.

TeliaSonera owns the second largest cable television network in Finland. The TeliaSonera network passes around 250 000 households. At the end of 2001, TeliaSonera had 148 000 cable television subscribers. At the same date, TeliaSonera had 10 000 cable modem subscribers, representing the equivalent of 4% of households passed.

The largest cable television network is the independently owned HTV. HTV launched its first cable system in 1975 and became the first network in Europe to offer pay television in 1978. In 1981, HTV was acquired by SanomaWSOY. HTV's network passed 320 000 households and served 237 000 cable television subscribers at the end of 2002. At that stage, HTV had 30 000 cable modem subscribers, representing a take-up rate of 9.4% of households passed.

Cable telephony is not offered by the largest cable networks in Finland. Ownership by telecommunication carriers is undoubtedly a major factor but the attractiveness of on-net wireless calls has meant a decline in the fixed market. It is therefore less attractive for independently owned cable networks. At the same time, there are notable performance gaps, in terms of the take-up rate for cable modems on the independent HTV network and those of the telecommunication carriers. This suggests that in some parts of Finland a major platform available to provide competitive broadband access is under-utilised for this purpose. Competition is developing more strongly in respect to DSL, as carriers with independent facilities and unbundled local loops offer services. In the final quarter of 2002, Finland was the second fastest growing broadband market in the OECD. This growth, however, was very strongly weighted towards DSL rather than cable modem.

France

In January 2003, the French telecommunication regulator released a report on the state of the cable market in France.²² ART (Autorité de Régulation des Télécommunications) underlined the low penetration of cable, in both the telecommunications and television markets. The report stated that at June 2002 only 13% of French households subscribed to a cable network. The report also cited the large difference in

penetration between DSL and cable modem, as well as the large difference in respective growth rates. By the end of 2002, there were 1.4 million DSL subscribers and 283 000 cable modem subscribers. The report also noted that cable networks in other countries make up a far larger share of the overall television and telecommunications markets than they do in France. The take-up of cable telephony subscribers on those networks offering this service, for example, is extremely low in France compared to networks in other countries.

After an extensive review of the French cable market, ART proposed three scenarios for the future development of the cable sector in France. These were:

- Consolidation: rationalisation of networks through area exchanges; consolidation of current cable players following the elimination of legislative barriers to mergers; grouping of existing players around a new entrant providing fresh capital.
- Separation of infrastructures and services, with the takeover of all physical cable infrastructures by a single operator in order to offer service providers unified access to all 8.5 million connectable households in France.
- The status quo and the technological erosion of cable, which might lead to decreasing interest in this medium.

It is not intended to repeat the analysis undertaken by ART. French cable operators face many of the same challenges as do other cable companies in other markets such as competition from satellite services and the need to find capital to invest in network upgrades. It needs to be noted, however, that as in a third of OECD countries, the incumbent telecommunication carrier is a major player in the French cable market.

France Telecom is the largest operator of French cable television infrastructure. The company's main vehicle for cable television is France Telecom Cable through which it provides direct services to subscribers. France Telecom also owns the cable network over which NC Numericable provides services. In addition, France Telecom owns a minority interest in Noos, which provides cable services over its own network but also uses part of France Telecom's network. France Telecom's share of Noos is the result of the retrocession of the Noos shares previously held by NTL prior to that company's bankruptcy reorganisation. Noos, NC Numericable and France Telecom Cable are the three largest providers of cable television services in France.

Experience in France, and other countries where the incumbent telecommunication carrier has a major stake in the cable industry, suggests several things in respect to the proposals forwarded by ART. Taking the proposals in reverse order, ART is correct that the status quo is unlikely to lead to a more dynamic contribution from cable networks to the development of communications in France. Cable networks owned by telecommunication carriers have a lower take-up rate for cable television and cable modems than independently owned networks. In addition, they do not provide cable telephony.

The separation of cable services from infrastructure provision is a further option raised by ART. Here it might be noted that experience shows that where there is a separation between cable infrastructure and services, the performance is not as good as where there is seamless provider. The performance of NC Numericable, for example, is not as good as France Telecom Cable in terms of the take-up of cable television or cable modems. It could, of course, be argued this is due to a competitor owning the underlying infrastructure and this would be a fair point. Accordingly, if the infrastructure provider was not the telecommunication incumbent, the situation might improve. On the other hand, cable companies in other countries, which both own infrastructure and provide services, have far higher take-up rates for all services than where there is a separation of infrastructure and services.

In Germany, even after Deutsche Telekom's exit from the first systems, the separation of Layer 3 and Layer 4 ownership appears to have hampered the introduction of new services (e.g. cable modems). A further example comes from Korea. In Korea, Thrunet filed for bankruptcy following the sale of its infrastructure after an attempt to become simply a broadband service provider over the networks of other companies. Thrunet's subscriber base stopped growing and then went into decline following the sale of its network assets and controlling equity interest in local cable companies. By way of contrast, the superior performance of France Telecom in selling DSL, and that company's rapid rollout of availability across France, demonstrates the value of co-ordinated network and service provision by the same entity.

The first option put forward by ART would appear to be the best way forward if it also included the divestiture of cable assets by the PSTN incumbent. The participation of a new entrant is always welcome in any communications market, though this need not necessarily be limited to one new player. This option may also involve the consolidation and rationalisation of existing networks in terms of number and geography. On the other hand, the evidence from many countries, such as Belgium, Canada and the Netherlands, show that regional cable companies can be very successful and are among the leaders in terms of best practice performance. While cable networks in all countries face common challenges, the main factor in this success is an independently owned cable sector capable of providing seamless networks and services.

Germany

The provision of cable television in Germany has historically been divided into four layers. Level One infrastructure was the transmission of broadcast signals from the source (e.g. satellite uplink).²³ Level Two was the signal to the cable head ends (e.g. satellite downlink). Level Three was the cable backbone (i.e. trunk network) and Level Four was the final connection into the subscriber's residence. Historically, Deutsche Telekom owned the entire Level Three infrastructure across Germany. On the other hand, Deutsche Telekom was only a Level Four provider in a small minority of cases, with final connections to the customers being provided by Level Four providers.

In 1999, Deutsche Telekom made the decision to sell majority interests in its cable networks and placed its Level Three assets in a separate subsidiary.²⁴ In addition, the company divided these networks into nine regions. At that stage, Deutsche Telekom's plan was to maintain a minority equity position in each of these networks to preserve its access to cable television subscribers and to be able to sell multimedia services. Telekom's initial approach was to look for institutional investors rather than to sell the networks directly to existing players in the cable market.²⁵ While Telekom insisted these entities were free to manage the systems, it was noted at the time that shareholders with 25% ownership of a company had the power to block certain decisions and merger agreements.

Deutsche Telekom reached the first agreements to sell majority stakes in February and March 2000. The first sale was the company's majority stake in the cable companies in North Rhine-Westphalia and Hesse. This was followed, in 2001, by Deutsche Telekom's sale of its majority interest in the regional cable television company for Baden-Wuerttemberg. This left Deutsche Telekom as the 100% indirect owner of cable television networks offering cable television services in six regions and as the holder of minority interests in three regions. The six regions remaining under full ownership accounted for approximately 75% of the geographic area of Germany and 58% of the German population.²⁶

In March 2003, Deutsche Telekom completed the sale of its six remaining cable TV regions. The sale concerns the cable activities that were still owned by Deutsche Telekom in the regions of Hamburg/Schleswig-Holstein/Mecklenburg-Western Pomerania, Lower Saxony/Bremen, Berlin/Brandenburg, Saxony/Saxony-Anhalt/Thuringia, Rhineland-Palatinate/Saarland and Bavaria. Deutsche Telekom has entered into long-term arrangements with the sold companies for the lease of some

of its infrastructure (*e.g.* cable ducts, glass fibres, technical facilities), but no longer has an equity position in the ownership of the companies in these six regions.

In April 2003, Deutsche Telekom still had a 40% interest in the regional cable company serving the German State of Baden-Wuerttemberg. However, financial restructuring of financially distressed cable companies in North Rhine-Westphalia and Hesse, during 2002, resulted in Deutsche Telekom no longer holding 45% and 35% equity positions in the respective cable companies in these regions.

The forgoing description of the structure and ownership of the German cable industry is necessary to be able to understand why cable telephony and cable modem services are almost wholly undeveloped in Germany in complete contrast to the extensive availability of cable television networks. At the end of 2001, there were 21.8 million cable television subscribers and cable networks passed 83% of all households. On the other hand, there were less than 20 000 cable telephony subscribers. In respect to cable modems, the German Cable Association says there were in the vicinity of 60 000 subscribers at the end of 2002. This compares with 3.2 million DSL subscribers at the same date.

The current under-development of the German cable sector is directly related to its structure and ownership. While the two are very much related, the structure can be considered first. It could be argued that the separation of the industry into different layers worked reasonably well for cable television. The fact that cable networks pass 83% of households is evidence that Deutsche Telekom, and the Layer Four providers, did a good job in terms of making the cable television service available. In those terms, one of the original policy objectives could be judged very successful. Furthermore, with 75% of homes passed subscribing to cable television service, the take-up rate is also relatively good. Where the system proved not to be able to make a transition was in the introduction of new services, such as cable telephony and broadband Internet access, as market liberalisation came into effect.

It might, of course, be argued that the separation of cable networks into different layers could have worked if Deutsche Telekom had not been the Level Three provider. Deutsche Telekom had, of course, very little incentive to upgrade cable networks to enable others to provide services that compete with its own. This is undoubtedly true in respect to the negative impact Deutsche Telekom's participation had on the roll out of new cable services. On the other hand, the initial experience in Germany suggests that there have still been problems, in the introduction of new services, where there is a continuing separation in the ownership of Level Three and Level Four.

For whatever reason, the new owners of Layer Three networks and the more than 5 000 owners of Layer Four networks have not yet been able to provide a platform that can provide services to compete with Deutsche Telekom. With Deutsche Telekom exiting the cable television market, this may change over time. Deutsche Telekom is moving rapidly to offer video services over DSL and this may act to make Level Three and Level Four providers more co-operative. On the other hand, it has been suggested that some of the new investors in Layer Three are not long-term players and will seek to resell networks as market valuations improve. To the extent this is true, it may hold back the development of new services if investment is not being made to offer such services.

To assess the best way forward, it would be necessary to have data available to compare the performance of companies that jointly provide Layers Three and Four to those where there is a separation of ownership. That being said, the window of opportunity may be closing for cable telephony. On the other hand, new opportunities are open to cable companies. Although Deutsche Telekom has raced ahead in terms of broadband access, the overall penetration in Germany is still low. At the same time, by entering the broadband market, VoIP service will become a possibility for cable companies. These opportunities can only be grasped, however, if both Layers Three and Four co-operate to a greater extent than has been witnessed to date or if there is a rationalisation of ownership to enable seamless service provision.

In the absence of an efficient cable sector it is necessary to employ other tools, such as unbundling and line sharing, to open up the broadband market in Germany. In contrast to other telecommunication carriers in the OECD, Deutsche Telekom's sales of DSL slowed dramatically in 2002 compared to 2001. In 2001, the company sold 1.6 million DSL lines but in 2002 could only manage 0.9 million lines. This could be in part due to Deutsche Telekom raising DSL prices but, at 3.9 DSL subscribers per 100 inhabitants, it would be expected that there would be tremendous scope for growth.

Greece

There are no cable television networks in Greece and consequently no cable modem or cable telephony services. Greece, with no independent cable television network to generate competition, was the final OECD country in which DSL commenced service. OTE, the incumbent telecommunication carrier, announced prices for DSL service in April 2003 OTE's prices for a 384 kbps, 512 kbps and 1 024 kbps downstream DSL service were respectively USD 70, USD 128, USD 241. These prices do not include the ISP (Internet Service Provider) component which is charged separately. The prices were very expensive compared to OECD countries where there is competition between cable and telecommunication networks or effective unbundling policies. The prices reflect a severe absence of competition in the Greek market. In the absence of alternative platforms, Greece needs to find some way to introduce competition. The introduction of effective unbundling and line sharing as a priority is one option.

Hungary

The Act governing telecommunications in Hungary has been in place since December 2001. Prior to that date Matáv, the incumbent telecommunication carrier, had been actively expanding its cable interests. Matáv Kábel TV, a division of Matáv, entered the cable television market in July 1998. Matáv Kábel TV launched its cable television service in six Budapest districts in January 1999. The Communications Act, adopted in December 2001, restricted Matáv from purchasing cable networks until 1 January 2004 and also restricted its building of new cable networks where the incumbent telecommunication carrier or another significant competitor has a telephone network. At the end of 2001, Matáv had over 300 000 cable television subscribers, compared to 7 000 subscribers in 1998. In 2001, the company reported no cable modem subscribers.²⁷ Axelero, Matáv's ISP, provides high-speed Internet access over Matáv Kábel networks in some areas of Budapest, Kaposvár, Erd, Dunakeszi, Budakalász and Esztergom.

The largest cable network in Hungary is owned by UPC. UPC's network passed 953 000 households at the end of 2002. Of these households, some 687 000 subscribed to cable television and 27 900 took cable modem service. In Hungary, UPC also holds an approximately 53.1% ownership interest in Monor Telefon Tarsasag, a fibre-optic telecommunications network in the Monor region of Hungary, that has offered telephony services to its subscribers since December 1994. UPC offered telephony service to 71 400 subscribers at the close of 2002, or a take-up rate of 7.5%.

Iceland

Síminn, the incumbent telecommunication carrier, began constructing a fibre to the curb (FTTC) – fibre to the basement (FTTB) network in 1994.²⁸ By September 2002, about 12 % of the households had fibre to their basement and all major companies are connected via fibre. In total, some 37 % of all homes are passed by fibre networks. Síminn uses the network to provide cable television and broadband Internet access services.

The television service of Síminn is called "The Broadcast" and began transmitting foreign TV-channels in 1998.²⁹ On the Broadcast there are 23 foreign channels sold as subscription, as well as six "free" local channels that are open to all. More than half of the households in the greater Reykjavík area

and about one-third of households outside Reykjavík have the option to connect to the Broadcast. Altogether this represents about 35 000 households and there were 5 500 subscribers to the cable television service.

In the absence of an independent cable television network, broadband competition has had to emerge from other platforms. The ITU has undertaken a case study of broadband development in Iceland.³⁰ That study shows that competition has developed using DSL via independently owned facilities and using unbundled local loops. Broadband via fixed wireless is also available and Wireless-LAN services are being introduced. Íslandssími, the leading competitor to Síminn, provides telephony to business and residential users over its own network facilities.

The cable television network has not played a part in market development in Iceland. The provision of such a service may have been used by Síminn to justify the initial deployment of fibre but, if that was the case, the results have probably not met expectations. At the end of 2002, the take-up of Síminn's cable television service was only 16% of homes passed probably because Icelandic content is freely available, with only foreign content being subscription based. On the other hand, the take-up rate for cable television on networks owned by incumbent telecommunication carriers is almost always lower than independent networks. That being said, the share of cable television is at such a low level that it is probably not influencing market developments.

Fortunately, healthy competition has developed even in the absence of an independently owned cable network. There were, for example, about five times as many broadband access subscribers to the Internet as there were cable television subscribers at the end of 2002. This is almost wholly due to competition between DSL providers. The main weakness of the Icelandic market is State and Municipal ownership of three of the leading competing players in the telecommunications market. The fourth player, Íslandssími, is privately owned. To a significant extent this could be addressed by the privatisation of Síminn which is 95% State owned. The government endeavoured to privatise Síminn in 2001, but did not receive offers it considered favourable. This has been postponed until economic conditions are judged more favourable.

Ireland

Competition between cable networks and the incumbent telecommunication carrier has been relatively slow to develop in Ireland. At the close of 2002, the largest cable network, owned by NTL, had just 6 400 telephony lines and only 1 500 cable modem subscribers. The penetration of cable telephony was the equivalent of just 1.3% of households passed. The penetration of cable modems to households passed was just 0.3%. This raises the question of why NTL has performed much better in the United Kingdom than in Ireland in developing telephony and cable modem services.

One factor is the time period in which NTL has owned a cable network in Ireland. Prior to 1999, the incumbent telecommunication carrier owned the majority share Cablelink. In 1999, the Irish government, as part of its privatisation of the carrier, decided to sell eircom's share in Cablelink. The objective of the government-approved sale was to ensure the upgrading of the Cablelink network to enable it to become an important provider of advanced multi-media services in a competitive environment.³¹ In May 1999, eircom sold Cablelink to NTL. Accordingly, NTL has been offering telephony for a much longer period in the United Kingdom than in Ireland. Prior to the sale, eircom had no incentive, of course, to offer cable telephony. That being said, the performance of NTL's cable subsidiary, in terms of rolling out cable telephony and cable modems, has still been very slow.

Other factors are more likely to have had a larger impact on the pace of development. Among these, the leading candidate was the financial state of NTL. NTL acquired Cablelink for around USD 700 million.³² This sum was three times the original valuation. This purchase was one of a number

NTL undertook in a significant expansion of its cable networks across in the United Kingdom, Ireland and continental Europe. In May 2002, three years after the Cablelink acquisition, NTL filed for Chapter 11 bankruptcy protection. In January 2003, NTL completed restructuring and exited bankruptcy.

Faced with a deteriorating financial position, between 1999 and 2002, NTL placed a priority on investments in those geographical and service markets where it faced the greatest competition. One such market segment was upgrading the network to provide digital television services in the face of competition from satellite services. By way of contrast, there appears to have been much less priority for telephony and cable modems in Ireland. NTL has upgraded its cable network to be in a position to offer digital services to 85% of households passed. On the other hand, broadband access is marketed to just 5% of all households passed by NTL Ireland's cable network. NTL began offering cable modem services to these households in November 2001. The main reason NTL could afford to delay launching cable modem services was the absence of such a service from the incumbent.

eircom was one of the last telecommunication carriers in the OECD to offer a DSL service. eircom launched DSL in April 2002 but the level of pricing indicated that, even then, the company was not earnestly marketing the service. At that stage, the baseline DSL offer was more than USD 110 per month.³³ Some twelve months later, in April 2003, eircom reduced its baseline DSL offer to USD 59 per month. eircom is also expanding the coverage area in which DSL is available but faces less pressure to do so because of the slow development of cable modem availability.

The Irish government took the right decision, in association with privatisation, to sell Cablelink and create an independent platform for competition. Unfortunately, through no fault of the government, the financial situation of the new owner has meant it has prioritised investment towards those markets where it faces the greatest competition. In the main, those markets are outside Ireland where the telecommunication incumbents have been much more proactive in introducing DSL. On a more positive note, unbundling is beginning to place competitive pressure on the incumbent, as evidenced by price reductions. NTL Ireland will need to develop cable modem services if it wishes to compete in this market segment. The performance of NTL in the United Kingdom suggests that this is likely to be the case, and the company's emergence from financial restructuring should assist this process.

Italy

Italy does not have a tradition of cable television. In 1996, Telecom Italia, in association with municipal authorities, launched the Socrates Project, involving the construction of a broadband access network harnessing "high capacity" transmission terminals such as fibre optics and coaxial cable.³⁴ The project was later abandoned. Telecom Italia says the main reasons were of an economic and financial nature, and owing to competition from alternative technologies such as DSL.

Following the liberalisation of the telecommunications market in 1998, it was thought that some new entrants might emerge offering a combination of cable television and telephony. However, the driving force in the creation of an alternative platform was broadband Internet access.

FastWeb – owned 64.4% by e.Biscom and 30.8% by AEM, Milan's main power utility, was the first Italian company to provide both business and residential customers with a network providing telephony, Internet and video on demand, via a fibre optic, Internet Protocol (IP) network. The company launched its services in Milan in 2000. By 2002, FastWeb's network extended 10 000 kilometres, including 6 000 kilometres of local access network. FastWeb's own fibre network passes 1.2 million households in the cities of Milan, Turin Genoa, Bologna, Naples, Rome and the region of Reggio Emilia.

Rai Click is a TV on demand venture set up by Rai (60%), Italy's state broadcaster, and e.Biscom (40%), which offers information, entertainment and services on broadband. Rai has made more than 10 000 hours of programmes available from its archives and current TV schedules, while the e.Biscom group contributes its infrastructure and network operation.

Launched on the FastWeb network in July 2001, Rai Click offers interactive video on demand. To watch the Rai Click channel on TV, viewers must be FastWeb customers. Users can browse past and present Rai programme schedules and select the material they want to see, at the time they prefer. Choices include news and current events, sport, variety shows, films and plays, cartoons, documentaries. Rai Click can also be viewed through personal computers with a choice of 3 000 programmes.

e.BisMedia's video on demand service over IP (Internet Protocol), is provided in Italy's six largest cities. The ARPU for video on demand increased steadily throughout 2002, more than doubling from USD 5 in December 2001 to USD 10.5 in December 2002. e.BisMedia closed a deal with the Turner Group for two theme channels to complement FastWeb TV's offer of commercial, terrestrial and satellite programming. Customers can watch CNN and the Cartoon Network without any additional installation of equipment.

One of the main reasons for the quick roll out of service in Italy has been FastWeb's access to rights of way. During the second half of 2001, FastWeb gained access to infrastructure developed under the Socrates plan. Before Socrates was abandoned, it had passed some 2 million households. By the end of 2002, FastWeb client numbers rose to over 176 000, more than three times the number of clients registered at the end of 2001. Each of these customers has access to all FastWeb services including telephony, video on demand and broadband Internet access at 10 Mbps. All telephony calls between FastWeb customers incur no additional charge on top of the fixed monthly fee.

Italy has benefited significantly from competition between Telecom Italia and FastWeb. For its part, Telecom Italia has accelerated the roll out of its IP network such that all voice traffic is carried over IP.³⁵ The incumbent says that it plans an all IP network by the first quarter of 2004. Competition is also lifting the level of service offered by the incumbent. Telecom Italia's initial DSL offer was only 256 kbps (downstream) but subsequently a range of offers was introduced up to 1.2 Mbps. This will undoubtedly increase as FastWeb becomes more widely available and increases the level of competition.

Japan

In March 2003, the number of DSL subscribers in Japan passed 7 million. This was a remarkable achievement given that Japan ended 2001 with just 1.5 million DSL subscribers. On the other hand, it is noticeable that cable modem service did not enjoy the same success. From the end of 2001 to the end of 2002, the number of cable modems increased from 1.3 million to 1.95 million.

The main reason for the very high rate of growth for DSL was the introduction of low prices. This was made possible by competitive entry using line sharing. DSL offers range from USD 20 to USD 30 for downstream speeds of 8–12 Mbps. Faced with extremely competitive offers, the cable television companies do not try to directly compete on price. They do, of course, have to compete on service performance. The basic cable modem service from the leading cable company, J-Com, is 8 Mbps downstream and 2 Mbps upstream.³⁶ However, if users wanted to take cable modem as a standalone service, they would need to pay USD 46. While this is inexpensive for that level of service compared to other countries, it is expensive relative to prices for DSL in Japan. Where cable companies do try to compete on price, it is by bundling together cable television, Internet access and telephony – or various combinations of these products at discounted prices relative to standalone offers.

The strategy of bundling services has continued to enhance the Japanese cable modem market but it has not been able to match the very rapid increase in DSL. There are, no doubt, other contributing factors. One is that cable television networks only passed around one in three Japanese households in 2002. While the coverage of cable networks has increased substantially in recent years, it does not match the four in five households that had DSL available at end 2002.³⁷ Accordingly, even if the price for stand-alone cable modems matched that for DSL it would be expected that DSL would grow more quickly because of wider availability. The other reason for lower take-up in Japan may be due to the relative popularity of cable television. The take-up rate for cable television, compared with the number of households passed on J-COM's network is relatively low compared to European and North American cable companies. This may, therefore, limit the number of users that are interested in bundled offers as compared to stand-alone products such as DSL.

While most interest in Japan, in recent times, has focused on the growth of DSL, there are also leading developments in respect to fibre to the home. At the end of 2002 there were 206 000 fibre to the home subscribers and by June 2003, this had grown to just over 458 000 FTTH (fibre to the home) subscribers. These services were priced from USD 45 upwards for 100 Mbps with one of the least expensive services being provided by a company called USEN.

USEN also has a background in the cable industry but not in the traditional sense. In 1961, USEN's founder saw the potential of providing background music for cafes and restaurants.³⁸ By 2002, the company had 1.3 million customers. The cable broadcasting service consists of extending coaxial cables to the customer's premises and providing them with a specialised tuner which allows them to pick up close to 400 radio and musical broadcasts. USEN say this can best be understood as an audio version of cable television.

In March 2001, USEN became the first Japanese company to offer commercial optical fibre FTTH broadband Internet services. USEN's services feature unlimited access Internet connection services at maximum speeds of 100 Mbps (upstream/downstream). In addition, the company provides paid online content services such as music and video on demand. USEN say that Japan's high household density with approximately 0.5% of the total area of the country accounting for around 20% of all households.³⁹ was one of the main reasons that they took decision to participate in laying down the "last one mile" required to deliver FTTH broadband Internet access to end users. USEN believes these areas are ideal for the use of fibre networks in terms of construction and maintenance.

USEN's network and service roll out is placing tremendous competitive pressure on NTT. The company not only needs to compete against entities such as "Yahoo BB!", offering inexpensive and very high-speed DSL services but also against FTTH providers. Accordingly NTT has brought down the price of its fibre to the home service and plans to have 80% availability by 2004. Accordingly, the traditional cable companies in Japan are going to face increasing competition in the provision of video services from entities such as USEN and NTT. In addition, "YahooBB!" plans to offer video services using vDSL (although present speeds of 8 to 12 Mbps are suitable for "television quality" video services).

For their part, the cable companies are also planning higher-speed broadband services using cable modems. In March 2003, J-COM's high-speed data service unit, J-COM Net, announced it would testing a new data service specification that can deliver Internet services at speeds of up to 30 Mbps.⁴⁰ J-COM Net currently offers downstream data delivery speeds up to 8 Mbps throughout all of its service areas. The new service will begin testing in May 2003 in part of J-COM Broadband Tokyo's service area. The upstream data speed will not change from its current capacity of up to 2 Mbps.

Japan's broadband market presents a tremendous array of choices for users at very low prices. Throughout 2002 and early 2003, users were electing to take inexpensive DSL services at between 8 Mbps

to 12 Mbps, in far greater numbers than for cable modems or fibre to the home. The question that may be answered in Japan, before other OECD countries, is whether there are services that will be developed to convince users to shift from DSL to fibre to the home. The cable companies are, of course, having to compete against both the other platforms with their HFC networks.⁴¹ Moreover, the different players in all platforms are moving quickly to offer triple play services, with tremendous competition developing in telephony.

Although cable telephony is offered in Japan and is growing apace, it may quickly be superseded by VoIP. J-Com offers telephony service, including local and long-distance calls, plus a large selection of optional services. At the end of 2002, J-Com had 350 000 households subscribing to telephone service. This number represented an increase of 110% over the previous year. On the other hand, "Yahoo BB!" launched a commercial VoIP telephony service in April 2002. In the 12 months to April 2003 the company signed up more than two million subscribers. The main attraction of the "Yahoo BB!" telephony service was the pricing. Calls between "Yahoo BB!" subscribers are "free". All other domestic calls and calls to the United States are priced at USD 0.06 per three minutes.

YahooBB's success in IP Telephony has forced all the other major players to announce their own VoIP service. J-COM launched a technical and operational test of Internet Protocol (IP) telephony services delivered via broadband cable in November 2002. Japan's tradition telecommunication carriers such as NTT and KDDI are also launching VoIP services. Competition among providers is also being rapidly extended in the provision of broadband Wireless-LAN. "Yahoo BB!" is offering a free trial W-LAN at a growing number of locations in Japan. For its part, in April 2003, NTT was offering a USD 13 per month flat rate W-LAN service.

Korea

Korea has, by far, the highest broadband penetration in the OECD area. At the end of 2002, more than one in five Koreans subscribed to a broadband provider. That meant, in terms of household penetration, that nearly two-thirds of Korean residential users had a broadband connection. In contrast to a number of countries where there is a debate over how to accelerate growth, Koreans are pondering whether their market has reached a ceiling. Indeed, the growth rate in Korea for the final quarter of 2002 was no longer among the leaders. This can, however, be misleading as growth is actually occurring in new directions. Koreans are shifting from basic broadband connections which are already among the highest in the OECD (*e.g.* 4 Mbps) to use services such as VDSL (*e.g.* 13 Mbps to 20 Mbps). At the same time, new technologies such as W-LANs are being rapidly adopted by Koreans to extend the coverage of broadband networks.

The development of broadband access in Korea has been extensively discussed in previous OECD reports. While many factors have been raised, there is one clear key to Korea's success. This key was vigorous competition in the provision of local access in a country with a high population density. These two factors, of course, exist in other countries but when they can be made to work in tandem they result in much higher growth rates. Hong Kong (China) and Chinese Taipei, for example, have a much higher broadband penetration than Singapore even though all three countries share a high population density. The level of competition is the key factor in each of these markets and high population density alone is not sufficient.

To appreciate why these two factors work best together, it is necessary to state one of the major barriers to the development of broadband access. That impediment is known as the, so-called, last mile problem (or first mile if that term is preferred). In most countries there may be only one or at best two platforms providing last mile connections over the whole country. Even in the latter case, when there are two platforms, they are sometimes owned by the same entity. Accordingly, the challenge for policy makers

is how to generate competition in the provision of broadband access where there may only be monopoly or duopoly infrastructure available over the last mile.

In Korea, the last mile problem was in one sense easier to address. Some 58% of Koreans live in apartment buildings with the inside wiring being owned by the buildings.⁴² A new entrant only needs to connect to the basement of these buildings to offer service to very large numbers of users. This is a much less challenging task than replicating last mile connections to individual detached dwellings. Hanaro Telecom, one of the new entrants in Korea, passed 75% of Korea households with their own network facilities less than five years after entering the market. To place this in perspective, cable companies in the United Kingdom pass half the households in that country after nearly 20 years of cable television service and ten years of telecommunications service. This comparison is drawn because the United Kingdom is one of the most successful countries in the OECD in the development of competitive facilities-based competition.

Once the last mile problem was overcome in Korea what might be expected to occur in theory did indeed eventuate. With the incumbent no longer controlling the bottleneck local access facilities, vigorous competition developed to deliver services. Faced with a loss of market power, the incumbent telecommunication carrier reacted by transforming itself, in a relatively short time, into an extremely competitive broadband provider.

Independently owned cable television networks have played a significant role in the Korean success story. Cable modem service was launched in Korea in July 1998 and DSL followed in April 1999. One factor that is sometimes overlooked is that the new entrants were generally agnostic about what technological platform they used to solve the last mile problem. Hanaro Telecom provides a good example. Although the company is well known for providing facilities-based DSL competition to KT, the company also used cable networks. At the end of 2002, for example, Hanaro had 1.5 million cable modem subscribers, compared to 1.3 million with DSL. In 2002, cable modems contributed 48% of Hanaro's revenue compared to 44% for DSL.

The first provider of cable modem services in the Korean market was Thrunet. Cable companies through which Thrunet provides service pass 57% of Korean households.⁴³ In January 2003, the company provided cable modem service to 1.3 million users. By mid-2002, however, Hanaro Telecom had overtaken Thrunet as the largest supplier of cable modem service, and the number of Thrunet's subscribers had begun to fall. In addition, from late 2001 onwards, Thrunet began to sell its controlling equity interests in local cable companies, and the company's HFC network facilities to Powercom, with the aim of only providing broadband access to subscribers through the networks of these companies.⁴⁴ This strategy does not appear to have been successful and runs against conventional wisdom in the communications industry which maintains that there is critical need to own access to customers. Following merger discussions with other players in the Korean market, Thrunet filed for bankruptcy in 2003.⁴⁵ One potential suitor for Thrunet, named in press reports, is KT, the telecommunication incumbent. Although a takeover by KT would lessen the degree of competition in the Korean market, it would have had a greater impact had Thrunet maintained ownership of its facilities.

In terms of telephony, PC to PC VoIP has been one of the most popular applications used by Korean broadband subscribers. Hanaro Telecom also provides telephony services. By the end of 2002, Hanaro had 679 000 residential subscriber lines and 250 000 corporate lines. The company had around 1 000 telephone to telephone VoIP customers.⁴⁶ To boost competition in telephony the Korean government plans to introduce number portability.⁴⁷ At the end of 2002, Hanaro had 4% of the local telephony market but gained 30% of net additional lines for that year.

Luxembourg

P&T, the incumbent telecommunication carrier, provides backbone cable infrastructure for some networks in Luxembourg. The cable television distribution networks in Luxembourg are gradually being adapted to offer access to bidirectional Internet services to all the customers. In May, 2002, two of the four largest cable service companies, Eltrona and Siemens, signed a contract with P&T for marketing TV-Surf. P&T has been a shareholder of Eltrona since 1st January 1999. The cable broadband service is called TV-Surf and is available at 256 kbps downstream and 64 kbps upstream. P&T also provides a DSL service at the exact same downstream/upstream capacity, and both services are marketed on the same Web site. As might be expected given the market structure, prices for both cable modem and DSL service are nearly the same and are at a relatively high level. Moreover, the price for the cable modem service comes bundled with a telephone line from the incumbent. Siemens also resells P&T's cable modem service.⁴⁸

In Luxembourg, the baseline P&T price for DSL is USD 65.19, whereas the baseline price for cable modem service is USD 66.34. Both prices have had the price of the telephone line excluded to make comparisons easier with other offers mentioned in this report. These offers might be compared, for example, to Belgium or the Netherlands where far much less expensive prices exist for much higher levels of service. The difference between Luxembourg and the two other Benelux countries is that there are independently owned cable infrastructures competing across Belgium and the Netherlands. This is not the case in Luxembourg, and this has led to a very low take-up of broadband access in both cable and DSL. One independent cable company is Coditel. In Luxembourg, Coditel provides cable modem service at 512 kbps and 1024 kbps.⁴⁹ By way of contrast, in Belgium Coditel offers a baseline service of 4 Mbps at a lower price.⁵⁰ This raises the question of why the level of service is so different between the two countries. The most obvious answer is that Coditel faces greater competition from the incumbent in Belgium than from the incumbent in Luxembourg. This is in turn, because Belgacom faces greater competition from other independent cable companies across Belgium than P&T does across Luxembourg.

Mexico

Cable television networks pass around one-third of Mexican households. In 1995, Telmex acquired a 49% stake in Cablevision, the cable operator in the Mexico City metropolitan area. Cablevision was separated from Telmex, in 2000, when it was spun off as part of the split with America Movil. Subsequently, America Movil sold its share in Cablevision to the other major shareholder major, Televisa, which is the largest media company and television broadcaster in Mexico. As well as controlling Cablevision, which is the largest pay television operator in Mexico, Televisa now controls the DTH (direct to home) satellite provider Innova. At the end of 2001, Cablevision had 452 000 cable television subscribers. Cablevision has signalled its intention to offer IP telephony and cable modem services.⁵¹

UPC's TeleCable owns and operates cable television systems in nine individual metropolitan areas in Mexico. In first quarter of 2001, TeleCable launched high-speed broadband Internet access services for its subscribers in five nodes in the Cuernavaca system. By the end of 2002, the company had 5 100 cable modem subscribers. As of 31 December 2002, the consolidated TeleCable broadband communications systems throughout the country of Mexico passed 298 100 households, incorporating approximately 80 700 analogue cable television subscribers. TeleCable is in the process of upgrading the technical infrastructure of its system operations to a 750 Mhz two-way architecture, which will allow TeleCable to introduce voice services to its systems in the immediate future.

Several other cable networks offer cable modem service in Mexico. Intercable offers a baseline cable modem service at 256 kbps for USD 47 per month.⁵² Other offers are at 512 kbps and 764 kbps. Megacable has more than 450 000 cable television subscribers. Megacable has a network with more than 11 000 kilometres of optical fibre and coaxial cable which enables the company to serve subscribers in

36 cities. Megacable offers Internet access to residential users at downstream speeds of 64 kbps, 256 kbps and 384 kbps. Megacable says that it has more than 100 000 Internet access subscribers, but information is not available to determine how many of these subscribers receive service at speeds that go beyond those comparable to “dial-up”.⁵³ In April 2003, Megacable’s service at 64 kbps was priced at USD 28 and the 384 kbps at USD 47.

One source puts the number of cable modem subscribers in Mexico at 130 000 as of April 2002.⁵⁴ At that stage, Megacable accounted for 80 000 of these subscribers. However, it is not known what proportion of Mexico’s cable modem subscribers receive service at 64 kbps. In April 2003, Telmex’s baseline DSL offer at 256 kbps was USD 47 while 512 kbps was priced at USD 85. Telmex’s DSL offer at 2 Mbps was priced at USD 470 per month. Telmex reported 66 000 DSL subscribers at the end of 2002.

To date, Mexican cable networks, with the exception of Megacable, have been relatively slow to roll out cable modem service. That being said, Megacable’s 64 kbps service would appear to be aimed at winning subscribers that would otherwise not shift from dial-up. The separation of Telmex from Cablevision should lead to a more competitive situation. In respect to telephony, Mexican operators appear to be waiting for IP telephony to mature before offering services.

Netherlands

The penetration of cable networks in the Netherlands is among the highest in the OECD. Cable networks pass 94% of all households. In December 1997, France Telecom acquired Casema for USD 454 million. The sale followed a decision by the Dutch government that KPN, the incumbent telecommunications carrier, should divest its cable network. This decision has undoubtedly contributed to the success of the Dutch cable industry in developing the broadband market in the Netherlands. At the end of 2002, Dutch cable companies served just under 800 000 cable modem subscribers. This was more than double the number of DSL subscribers. This is not to argue that importance is attached to which platform has the most subscribers. Rather it points to the pressure cable companies are exerting on the incumbent to roll out DSL service. This pressure is reflected in the growing take-up of both cable modems and DSL. The Netherlands recorded the sixth highest growth in the OECD during the final quarter of 2002.

Dutch cable companies have also introduced cable telephony. The largest cable network in the Netherlands is owned by UPC which, in 2002, passed 2.5 million households. At the end of 2002, UPC had 170 000 telephony subscribers and 303 000 cable modem subscribers. UPC has introduced two fixed-fee telephone services: MaxiBel and MaxiInternet. Both products are for fixed-line subscribers only. UPC is the first communications operator in the Netherlands to offer fixed-fee telephony. MaxiBel is limited to national calls. For a monthly subscription rate of USD 20, subscribers can call up to 15 hours per month.

Essent Kábelcom is the second largest network in the Dutch cable sector.⁵⁵ It is active in the areas of telecommunications, data communications, radio, television and Internet, both for the consumer market and for the business sector. At the end of 2002, Essent had 1.7 million cable television connections and 190 000 cable modem subscribers. Essent’s cable telephony product is called “Twinner”. This product provides telephony and Internet access to the inhabitants of seven large cities in the north of the Netherlands. In February 2003, Essent’s Twinner service had 30 000 subscribers.

Under France Telecom’s ownership, Casema, the third largest cable network, did not launch a residential cable telephony service.⁵⁶ The reason given by France Telecom was that it did not believe a telephony service would be successful until it could be provided over the same platform as Internet access. Casema did, however, launch cable telephony for business users serving some 99 corporate customers by end-2001. At the end of 2002, Casema had 132 000 cable modem subscribers. France Telecom sold Casema for USD 677 million in January 2003.⁵⁷

New Zealand

During 1996 and 1997, Telecom New Zealand constructed a hybrid fibre-coaxial cable network that passed 70 000 households in various parts of the country and began offering a pay television service. In 1998, Telecom New Zealand discontinued its pay television service. TelstraClear is the only provider of integrated telephone, pay television and Internet services in New Zealand. These services are currently provided in the greater Wellington area over a hybrid fibre cable network with an overlay of traditional telephone lines. Service to Christchurch was launched in early 2001. TelstraClear also plans to construct a network in Auckland but the use of overhead cable has proved controversial.⁵⁸

Press reports indicate that in suburbs where TelstraClear and Telecom New Zealand are both competing, the penetration rates are three times that of other suburbs.⁵⁹ However, such competition is limited to the households passed by TelstraClear's network. Outside those areas covered by TelstraClear's network, there is very little alternative infrastructure. At the same time, as there is no unbundling in New Zealand, DSL competition is limited to ISPs competing using Telecom's wholesale offer. The most notable characteristic this engenders, in the New Zealand broadband market, is metered pricing for broadband access.

Telecom New Zealand does offer a flat rate for DSL service only at the sub-broadband speed of 128 Kbps. For broadband access the baseline offer contains only 500 Mbytes before metered charging applies. Rather than providing an alternative to this pricing structure, TelstraClear's pricing mirrors the structure of Telecom New Zealand with the baseline broadband offer having a 500 Mbyte cap. The other notable feature is that Telecom New Zealand and TelstraClear treat their own traffic differently from other content providers. For example, a user playing games on Telecom New Zealand's server would not have this traffic counted toward their download limit and would receive a higher access speed even if they subscribed to the 128 kbps service. Similarly, a user of TelstraClear's content and games would also not have this traffic count toward their download limits. If growth rates in New Zealand were better than has been the case to date, it might be possible to argue that metered pricing was popular with users. New Zealand's broadband penetration, including subscribers at 128 kbps, has however been very slow to develop compared to other OECD countries. While some competition has developed where cable networks are available, and users in these areas have undoubtedly benefited, the pricing choice appears to be what would be expected under a duopoly. In this situation, further efforts to open local access to competition, such as through the use of unbundling, need to be considered.

Norway

As in the other Nordic countries the involvement of the incumbent telecommunication carrier in the cable television market has slowed the growth of competition in cable telephony and broadband Internet access. Telenor, the incumbent telecommunication carrier is the second largest operator of Norwegian cable television networks. At the end of 2002, Telenor had 363 000 Norwegian cable television subscribers. Telenor's network passes around 530 000 households. As at June 2002, Telenor had just 16 000 cable modem subscribers, representing a take-up rate of only 3%.

The largest cable operator in Norway is UPC. UPC offers cable modem services and cable telephony. In contrast to Telenor's cable network, UPC's take-up rate for cable modem service was 6.5% at the end of 2002. While UPC's offer has been in the market longer, another sign of competition at work, it still provides evidence of superior network utilisation from an independently owned system. UPC launched its cable modem service in July 1998. Telenor Avidi launched cable modem services in southern Norway in 1999. As in other countries where the launch of DSL was recent, UPC did not face competition for some time. Telenor's commercial DSL service was not launched until December 2000. This in part explains the

lower take-up rate on UPC's Norwegian network than in other UPC markets. UPC Norway does, however, offer cable telephony. At the close of 2002, the company had 21 800 telephony subscribers.

In a similar manner to Sweden, the major competition to Telenor, in the broadband Internet access market has not come from cable television networks but from the entry of a third player. Nextgentel connect their broadband customers by leasing the local loop and co-locating multiplexers and routers in the local exchange offices of Telenor. By these means Nextgentel began offering DSL services in Bergen in Spring 2000. For a fixed monthly price, users can be connected at downstream speeds ranging from 704 kbps to 8 Mbps. By the end of 2002, Nextgentel had connected 40 000 subscribers and, prompted by competition, the Norwegian DSL market was growing apace. By way of contrast, cable modem service was growing much slower due to the under-utilisation of Telenor's cable network.

Poland

Cable television networks pass around 30% of all households in Poland. In June 1999, UPC acquired ownership in the largest of Poland's cable networks (@Entertainment, Inc). At the end of 2002, UPC's network passed 1.8 million households. @Entertainment's fibre-optic cable television networks serve in excess of 65% of its subscribers. All of @Entertainment's cable networks have bandwidths of at least 550 Mhz, with one network as high as 1 Ghz. UPC says that new portions of the networks that are currently being constructed are being designed to have minimum bandwidths of 860 MHz and @Entertainment intends to upgrade any portions of its cable networks that have bandwidths below 550 MHz (generally acquired from other entities), to at least 860 MHz. At the close of 2002, UPC had 13 900 cable modem subscribers.

One interesting aspect of the Polish market is that UPC has been able to avoid constructing its own underground conduits in certain areas by entering into a series of agreements with TPSA (the Polish incumbent telecommunication carrier), which permit @Entertainment to use TPSA's infrastructure for an indefinite period, or for fixed periods of up to 20 years.⁶⁰ As of 31 December 2002, more than 77% of @Entertainment's cable television plant has been constructed utilising pre-existing conduits from TPSA. UPC Poland does not offer cable telephony services but some of the other cable television companies do provide this service. At the end of 2001, there were 22 000 cable telephony subscribers.

El-Viv Telecom. is a provider of cable TV and broadband Internet services operating in Warsaw, Krakow and Zielona Gora. El-Viv Telecom. is currently 100% owned by Elektrim Telekomunikacja, which is in turn owned by Elektrim of Poland and Vivendi Universal, France.⁶¹ The leading cable company owned by El-Viv is Aster City Cable. Formed in 1994, Aster City Cable has offered its 280 000 Warsaw subscribers cable television, telephony, and high-speed Internet access since March 2000. Aster City Cable was the first operator in Poland to introduce broadband Internet services and, as of mid-2002, service was taken in 15 000 households.⁶²

The number of cable modems in Poland is relatively small, but UPC and Aster City alone had more than twice as many subscribers as TPSA at the end of 2002. While the financial difficulties of the parent companies of Poland's leading cable networks may have slowed developments, they are providing competition to the incumbent telecommunication carrier for broadband access and cable telephony. By way of contrast, Netia, Poland's largest alternative provider of fixed-line telecommunications services, had yet to launch residential DSL service by end-2002.

Portugal

There are two major players in the Portuguese cable television market. The largest cable television network is owned by the incumbent telecommunication carrier. Telecom Portugal's subsidiary PT

Multimedia has a cable network (TV Cabo) which passed 2.3 million households at the end of 2002. TV Cabo's licences cover 77% of the Portuguese population, comprising approximately 3.7 million households. At the end of 2002, TV Cabo had just over 1 million cable television subscribers and 140 000 cable modem subscribers. TV Cabo's network was constructed from 1994 onwards.

The second largest cable network in Portugal is operated by Cabovisão. Cabovisão offers cable television, high-speed Internet and telephony services to residential customers.⁶³ Cabovisão's licences entail nine authorisations for different areas of Portugal, with a potential of 4.5 million homes, or 90% of the country's residential market.

Construction of Cabovisão's bi-directional hybrid fibre coaxial (HFC) network commenced in Portugal in 1996. By end 2002, the network reached over 735 000 households. In 2000, Cabovisão began construction of a national fibre-optic backbone which was completed and activated during the first quarter 2002. Cabovisão launched cable television distribution services in Portugal at the end of 1996 and Pay-TV services at the end of 1998. High-speed Internet access was introduced at the end of 1999, followed by cable telephony services in the third quarter of 2000. In September 2002, Cabovisão had 56 000 cable modem subscribers and 148 000 telephony lines.

The most striking feature of the Portuguese cable market is that, like Australia, there are two cable companies competing in the same region. These two countries are the only ones in the OECD where there is a majority overlap between cable networks. This has led to a number of common characteristics between the two markets and a number of parallels that can be drawn in how services developed. The first notable feature is that licensing two operators in the same region leads to a very fast roll out of cable television networks. This is because the operators believe there is a significant first-mover advantage in terms of cable television. It also reflects the telecommunication carrier's strategy of defending their traditional telephony market by denying the new entrant the ability to win all triple play customers.

A further set of common features has emerged in Australia and Portugal. In both countries, the incumbent telecommunication carrier launched cable modem services before DSL. TV Cabo launched cable modem services in November 1999 which was more than twelve months ahead of Telecom Portugal's launch of DSL. Telstra launched cable modems some four years before DSL, albeit the launch of DSL was delayed for twelve months for regulatory reasons. In both cases, the threat of competition in the same market with the same product is the likely reason for the earlier launch. The strategy is clearly to deny the new entrant the ability to gain triple play market share using their own infrastructure. That being said, technical factors may also have been in play. In both countries, cable networks were of relatively recent provenance perhaps making them more amenable to any necessary upgrades to provide broadband than the PSTN.

A further contributing factor to the earlier launch is that regulators were likely to order the incumbent to introduce a wholesale DSL offer (or to introduce policies such as unbundling and line sharing) as soon as the incumbent launched DSL. By way of contrast, this regulatory outcome was unlikely in respect to cable modem service. In fact, in both Australia and Portugal, the incumbent only launched DSL after these decisions had been made by the regulator. In the case of Australia this involved a twelve month delay, to the eventual introduction of DSL, while an industry self-regulatory process was carried out to develop technical standards for local loop unbundling and wholesale DSL services..

In both countries, the results are also very similar in terms of market growth and penetration. Cabovisão, like Optus, has been able to win a significant amount of cable telephony customers. In September 2002, Cabovisão had the equivalent of 20% of households passed electing to take cable telephony. Like Optus, in Australia, this is one of the highest take-up rates in the OECD and only bettered by companies in the United Kingdom. On the other hand, there is mixed success in terms of broadband

take-up. By owning cable networks the incumbents in both countries were much slower of the mark in terms of DSL. Regulated wholesale access is beginning to have a positive impact in Australia but growth is still relatively slow compared to countries where the telecommunication carrier needs to use DSL to compete against independent cable networks. It is true that the cable networks of Telstra and Telecom Portugal perform marginally better than those of incumbents with no cable overbuild (*i.e.* no same network competition down the same street). On the other hand, it may be precisely because of this that they do not need to compete as hard in the DSL market. It is noticeable that baseline offers for DSL, in both countries, are low speed compared to operators that do not own cable networks. In both markets, the only regulatory remedy for slow growth is either divestiture or making unbundling work at a more efficient level than in countries with wholly independent cable networks. Careful analysis of the emerging trends in broadband take-up in both markets will assist policy makers to decide upon the best course.

Slovak Republic

At the end of 2001, cable television networks passed 35% of households in the Slovak Republic. Of these, only 420 households subscribed to cable modem service and there were no cable telephony subscribers. In the case of the latter, this was as a result of Slovak Telekom still having a monopoly over the provision of telecommunication services. That being said, the largest cable network, UPC Kabeltel, was still not offering telephony by the end of 2002. UPC Kabeltel also reported no cable modem subscribers at the end of 2002. UPC does say, however, that systems have been constructed to 860 Mhz technical standards, allowing for eventual introduction of high-speed Internet access, voice and e-commerce services.⁶⁴ The end of the telecommunications monopoly in the Slovak Republic enables cable companies to freely enter these markets. The current low development of telephony and broadband Internet in the Slovak Republic appears to be for similar reasons to the situation to Ireland. One factor is the financial difficulties experienced by the parent company of the largest cable network. UPC filed for bankruptcy protection in 2002, with plans to complete financial restructuring during the first half of 2003. For its part, Slovak Telekom was one of the last incumbents to launch DSL, with services commencing in 2003. Accordingly, a combination of a parent company in a weak financial position and an incumbent not offering DSL service meant that the cable company placed its priorities in other markets.

Spain

The development of cable television in Spain is relatively recent. Following the liberalisation of the Spanish telecommunications market, Spain's Cable Law prohibited Telefónica from offering cable services for two years. In 2003, the only existing restriction is that Telefonica is obliged to provide services by cable through subsidiary companies established for this purpose.

During 2002, Telefonica Cable provided cable services on a trial basis in a number of Spanish regions and has provided cable services in Menorca since 1998. On the 31 January 2002, the Spanish government approved a resolution which provided provisional authorisation for offering video on demand services and a concession for the provision of broadcast services. Telefonica's pay-TV via ADSL trial, in Alicante, was called Imagenio. The programme offered high-speed Internet access, 25 TV channels, 15 audio channels and rental of a decoder for USD 82.⁶⁵ Telefónica's plan is to reach every household throughout Spain via DSL lines offering triple play in competition with the cable companies.

Spain's strategy for developing the cable market in competition with the PSTN, by delaying the incumbent's entry into the market, appears to have been relatively successful. For its part, Telefonica moved to quickly upgrade the PSTN to provide widespread availability of DSL. For example, by the end of 2001, some 81% of the Spanish population could receive DSL service. This was increased to 89% by the end of 2002. One of the reasons Telefonica acted quickly was that the company wanted to provide video

services over the PSTN. At the same time, Telefonica also provides pay television services via satellite to 806 000 subscribers.

In 1998, Spain's cable companies began offering cable television and cable telephony services. By 2003 there were two main independent players in the cable market. ONO offers direct access telecommunications, cable television and high-speed Internet access to residential and business customers in four large geographical clusters around Spain where the company has a potential market of over 4 million homes in its various franchises. ONO also has a national network which allows the company to offer advanced value-added data services and applications to the business sector throughout Spain.

At the end of 2002, ONO's network passed 1.76 million households. One of the most interesting aspects of the development of services to date is that ONO has more telecommunication subscribers than cable television subscribers. In 2002, the company had 448 000 telecommunication subscribers and 296 000 cable television subscribers. At the same date, ONO provided broadband Internet access to 117 000 subscribers.

The other major player in the Spanish cable market is AUNA. AUNA's network provides telephony, cable television and cable modem access (128 Kbps to 600 kbps). The company also has a backbone network in all the Spanish provinces, with more than 12 000 kilometres of optical fibre cable. At the end of 2002, AUNA had 521 000 customers on its own cable network and more than a million clients through indirect access, of which more than half are pre-selected. AUNA's direct fixed network customers have grown five-fold since 2000. By end 2002, the company provided 797 000 lines. AUNA also offers DSL services at 2 Mbps to business users.

Infrastructure competition is developing apace in Spain. The cable companies have had most success in developing the telephony market but more recently cable modem service is also beginning to grow quickly. By the end of 2002, Spain had more than 250 000 cable modem subscribers and the companies were providing significant competition to Telefonica. The possibility of a merger between the two largest cable providers was mooted in the Spanish press in early 2003. At the same time, the cable companies protested against the merger of Spain's two satellite services – CanalSatellite Digital owned by Sogecable, and Via Digital in which Telefonica has a share. According to ONO, the merger risks creating a monopoly controller of television content.⁶⁶

One factor that sets Spain apart from most OECD countries is that the incumbent telecommunication carrier also owns a free-to-air television broadcaster. Canada is another country where this occurs. In Spain, no entity or person is allowed to own more than 49% of a privately owned free-to-air television broadcaster. At the end of 2001, Telefonica, through Admira Media, owned 47.5% of Antena 3, one of the leading privately owned television stations in Spain. On the other hand, Telefonica is one of the very few incumbent carriers in the OECD operating telecommunications, cable television, satellite television and free-to-air television in the same market. In Canada, incumbent telecommunication carriers do not, for example, provide cable television service. The ability for Telefonica to act across all platforms perhaps helps explain why new entrants have been more successful in gaining market share in telephony than in cable television. For example, the cost of the rights to broadcast the Soccer World Cup could be spread over several platforms, including the Via Digital satellite service and Antena 3.

During 2002, Telefonica announced it would like to sell or list shares in Antena 3 and this process was underway in early 2003. Press reports indicated that the main motivating factor involved in the sale were new government regulations forbidding companies from owning shares in more than one broadcaster in Spain.⁶⁷ The theory being that in order for Telefonica to carry out its planned satellite pay-TV merger with Sogecable, both companies would have to sell interests in other broadcasters. In April 2003, the Spanish Competition Commission gave its approval for the merger between the Sogecable-owned Canal

Satellite Digital and Telefónica-controlled Via Digital. The Spanish government has also announced plans to further liberalise the cable market by allowing new entrants in the market.⁶⁸

Sweden

Cable television networks pass around 65% of all households in Sweden. Despite the widespread availability of cable television, the number of households taking cable telephony and cable modem service is relatively small. The primary reason for this, as in other Nordic countries, has been the involvement in the sector by the incumbent telecommunication carrier. At the end of 2002, TeliaSonera, the incumbent carrier, owned ComHem which is the largest cable television network. As a condition of the merger between Telia and Sonera, the European Commission directed Telia to divest its cable network in Sweden. The sale was announced by TeliaSonera in April 2003.⁶⁹

In those areas served by Comhem, by the end of 2002, only 2.7% of households passed by their network elected to take cable modem service. This indicates that the platform is significantly under-utilised for the provision of broadband access.

The second largest cable network is owned by UPC. In contrast to TeliaSonera's network, at the end of 2002, there was a 15% take-up rate for cable modem service in households passed by the UPC network. The difference between the adoption rates for cable modems illustrates the value of an independently owned cable network. On the other hand, UPC's cable network does not offer cable telephony. As in other Nordic countries, this may be due to the impact of wireless making the market less attractive.

Due to TeliaSonera's ownership of the largest cable network, the main competition in Sweden has come from a third platform. The largest such provider is Bredbandsbolaget (B2), which uses Ethernet LANs to offer services in apartment buildings. The company provides Internet access at 10 Mbps and some cable television services such as BBC Prime. B2's network passed 260 000 households with some 94 000 subscribers by April 2003. B2 commenced offering telephony services without the need for TeliaSonera in April 2003. B2 has also commenced a broadband access service for business users of USD 1 500 per month for up to 100 Mbps.⁷⁰ B2's residential service is at 10 Mbps for less than USD 30.

While cable television networks have provided competition in some parts of Sweden, it is undoubtedly the entry of a third player which has stimulated the broadband access market. Sweden's broadband access market initially had some of the least expensive prices for access among the OECD. This was at a time when both the incumbent telecommunication carrier and B2 were intensely competing to sign up housing associations for their service. Subsequently prices rose, but are still relatively inexpensive compared to other European countries and, in the case of B2, compare very favourably in terms of the basic level of service (*i.e.* 10 Mbps). In the absence of cable telephony, B2's entry into this market is also welcome. Overall, the Swedish market should become more competitive as TeliaSonera divests its cable television network.

Switzerland

The largest cable television network in Switzerland is Cablecom. Cablecom was formed in 1994 through the merger of four cable concerns. Swisscom, the incumbent telecommunication carrier acquired a 32% share of Cablecom through investments in 1994 and in 1995.⁷¹ The total value of these investments was around USD 50 million.

In 1997, the Swiss Competition Commission recommended that Swisscom should be required to divest its share of Cablecom, arguing that Swisscom would hinder Cablecom from competing against Swisscom in the local loop.⁷² The Swiss Federal Council did not adopt this recommendation and allowed Swisscom to retain its shareholding. Subsequently, in June 1998, Cablecom, acting against Swisscom's

vote, entered the Swiss Internet market by acquiring one of Switzerland's largest ISPs and began to build its own backbone for data services. As a result, Swisscom decided to sell its stake in Cablecom.

In December 1999, the sale of Cablecom to NTL was announced for USD 3.4 billion. The sale was completed in March 2000 and Swisscom received around USD 1 billion for its stake in the company. The price achieved by Swisscom was a remarkable return on its original investment. However, the company is on record as saying that the reason for the sale was that Cablecom entered the Internet access market in competition to Swisscom. This frank admission highlights why cable companies owned by telecommunication carriers either do not compete with the PSTN or are vastly under-utilised as platforms for broadband Internet access. Notwithstanding the reasons for the sale, Switzerland has benefited from the competition provided by Cablecom.

Apart from offering broadband Internet access, Cablecom, following a trial in February 2003, now offers Internet telephony over this connection.⁷³ Customers connect their telephone to the cable television network using the cable modem provided. In respect to cable modems, the Swiss Cable Association reported that there were 260 000 at the end of 2002. This compares to 195 000 DSL subscribers. Both platforms grew by around 60 000 subscribers each in the final quarter of 2002. This would clearly have not been the case if Swisscom had retained ownership and been able to convince the other shareholders of Cablecom not to enter the Internet market.

Turkey

Turk Telekom has a monopoly over the provision of telecommunication services until the beginning of 2004. Turk Telekom also owns all cable television network infrastructure, and other companies provide television services. Turk Telekom has a revenue-sharing arrangement with the cable television service companies. For example, Topaz has revenue-sharing arrangement with Turk Telekom, whereby revenues are shared for a period of ten years up to 2007. During this period all expenses related to cable television network instalment are borne by Topaz.

One of the largest service companies is Ultra Kablo TV. That company provides cable television service to more than 190 000 subscribers in 12 provinces under a revenue-sharing agreement with Turk Telekom. During 2001, Ultra launched high-speed Internet cable services to its subscribers. As is the case in Luxembourg, Turkey's cable television companies refer customers to the price of services from the incumbent telecommunication carrier for cable modem access. In March 2003, cable modem services were available at the following range of downstream/upstream capacities 64/16 kbps, 128/32 kbps, 256/64 kbps and 512/128 kbps.⁷⁴ Among these options, Turk Telekom's price for cable modem access at 256/64 was priced at USD 65 per month. The price, from Turk Telekom, for 512/128 kbps was USD 116.

Due to Turk Telekom's monopoly, there are no cable telephony services offered by cable television companies in Turkey. Although the telecommunications market will be liberalised in 2004, existing revenue-sharing arrangements for cable television services will continue to exist for the term of such agreements.

United Kingdom

The United Kingdom has had the longest experience of any OECD country in terms of full service competition between telecommunication carriers and cable companies. While cable companies could provide some telephony services prior to the end of the telecommunications duopoly, none did so in a significant way. From 1992 onwards, however, cable companies entered the telephony market and increasingly captured market share. In 2002, OfTel data showed that NTL and Telewest provided 15.1% of all telephone lines in the United Kingdom.⁷⁵ This was up from 7.5% in 1998.

The licences to provide cable television service in the United Kingdom were originally allocated through regional franchises. BT was free to bid for regional licences but did so in only a small number of cases (Westminster and Milton Keynes). On the other hand national telecommunications companies such as BT were prohibited from providing broadcast services to households over their networks. This restriction was lifted in 2001 but in any case was not considered to apply to broadcast services delivered over the Internet.

In May 1997, BT, British Sky Broadcasting Group, Midland Bank and Matsushita Electric announced the formation of British Interactive Broadcasting Limited ("BiB"), an independent company created to deliver digital interactive services to television viewers in the United Kingdom.⁷⁶ In May 1998, BT gave undertakings to meet the concerns of the European Commission (EC) in approving the formation of BiB. As part of the approval package proposed by BiB and its shareholders, to meet the Commission's concerns, there was a proposal from BT to divest itself of its cable television interests in Westminster and Milton Keynes. The EC considered that BT's control of the existing broadband delivery mechanism in these areas raised competition issues in the light of BT's participation in BiB. BT says it agreed to this because BiB represented a major strategic thrust into interactive TV services. Its services would be available across the whole of the United Kingdom and were expected to stimulate the total multimedia market. By contrast, BT says its cable interests were not core to the company's strategy in the United Kingdom.

The divestiture of BT's cable networks added to the independence of the sector in providing a competitive platform for cable telephony and broadband Internet access. NTL launched cable modem service in April 1999. This was more than a year ahead of the launch of DSL services in July 2000. That being said, by the end of 2000, the number of DSL lines exceeded the number of cable modem connections. The most likely reason for the initially very slow roll out of cable modems, and to a somewhat less extent DSL, were two-fold. First was that the focus of the cable industry was very much on consolidation within the United Kingdom and expansion into foreign markets. During this time, very high prices were paid for cable mergers and acquisitions within the United Kingdom and abroad. For its part, BT was also squarely focused on international expansion rather than broadband access. The second factor was the industry's priority on introducing flat rate dial-up Internet access which, at that stage, was what was being demanded by the market. In both cases, factors that initially slowed the development of broadband access are now contributing to its success.

Following the end of the financial bubble in the telecommunications and cable sectors, both BT and the cable companies have undergone major restructuring and sales of foreign assets. These companies are now clearly very focused on developing domestic broadband access. It would be fair to say that the cable companies made the shift in 2001 when the number of cable modem customers overtook the number of DSL subscribers. In 2002, BT began to seriously market DSL services by lowering prices and introducing self-install modems. While the industry in the United Kingdom, like that in many countries, was sidetracked by the financial bubble in communications, it is now witnessing the same success in broadband access as has been achieved in cable telephony. One caveat seems to be the higher proportion of users electing for sub-broadband cable offers than in other countries where data are available.⁷⁷ That being said, low prices for cable modem services, at 128 kbps, may be particularly attractive to low-income groups in some urban areas served by cable television networks that would otherwise not take an always-on service. Over time, it would be expected that competition would raise the level of service above Oftel's criteria for broadband access in the United Kingdom, at 256 kbps.

United States

The Telecommunications Act of 1996 removed barriers to incumbent local exchange carrier (ILEC) entry into the video marketplace in order to facilitate competition between incumbent cable operators and telecommunication carriers.⁷⁸ Prior to the 1996 Act, ILECs were not permitted to offer cable television

services in their own regions. At the time of the 1996 Act, policy makers expected that ILECs would compete in the video delivery market and that cable operators would provide local telephone exchange service.

By 2003, part of the intention of the 1996 Act had been realised. The National Cable and Telecommunications Association (NCTA) reports that cable companies supplied 2.5 million residential telephony lines by the end of 2002.⁷⁹ This represented a take-up rate of around 2.6% of all households passed by cable. While this number is relatively small, it is noteworthy that almost all the growth has occurred in just two years since 2000.⁸⁰ At the beginning of 2000, cable companies had around 180 000 telephony subscribers in the United States. In the subsequent two years, they added 2.3 million subscribers. One reason for this pattern of growth is that it takes time to upgrade networks to offer telephony services. Accordingly, it has been largely from 2000 onwards that the cable industry has been able to offer a widespread alternative platform for residential telephony. Between 1996 and 2003, the cable industry invested USD 70 billion in upgrading networks to offer a range of new services.⁸¹

Based on the increasing pace of growth of cable telephony in the United States, it can be concluded that one of the main aims of the 1996 Act is coming increasingly to fruition. On the other hand, the expectations in relation to ILECs competing in the cable television market have not been realised. Although some ILECs began to provide cable services after 1996, the four largest incumbent local exchange carriers had largely exited the cable business by 2001. Three of the four ILECs have shut down their “in region” cable franchises. The exception is Bell South which in 2002 held franchises to pass 1.4 million homes. That being said, the number of subscribers to Bell South appears to be so small as to be insignificant. Bell South does not report these data in their quarterly or annual reports.

Although telecommunication carriers have largely not yet entered the video delivery market, the cable industry has been losing market share to satellite providers. Direct broadcast satellite (DBS) service has grown significantly and, by 2002, represented 20.3% of all multi-channel video programme distributor subscribers.⁸² The number of cable television subscribers is still growing but the industry’s main success in recent years has been in driving the take-up of broadband access in the United States. At the end of 2002, Cable companies provided 11.3 million cable modem connections. This number significantly exceeded the 6.5 million DSL lines provided by telecommunication carriers in the United States. One reason why cable is growing faster is that the cable companies consistently offer higher levels of broadband access speeds than do incumbent telecommunication carriers. In New York, the baseline offer for Time Warner’s Road Runner service was 2 Mbps compared to 768 kbps for the incumbent in April 2003. Faced with this competition, Verizon cut the cost of its baseline DSL service by 20% to USD 34.95 in May 2003.⁸³ Moreover one report said the company was doubling the line speed to 1.5 Mbps for customers within a 1.1 kilometres of the exchange, while reducing the price.⁸⁴ Cable “over-builders” add to the competitive mix. RCN, for example, offers double the baseline speeds than does its DSL and cable competitors in Chicago.⁸⁵ If other incumbents follow Verizon’s lead, DSL will provide an increasingly competitive platform to cable modem services and the rate of growth will substantially increase in the United States.

Overall, it can be concluded that the market for telephony and broadband access is increasingly competitive in the United States and that the independently owned cable networks are making a significant contribution to this trend. For the future, the United States is also looking to increased competition from a new generation of satellites and broadband access via power-lines. The latter platform has not yet had successful commercial deployment in other countries. However, if the technical barriers can be overcome, in the United States, it will add a widely available additional platform.⁸⁶ Apart from providing local loops over power-lines, it may also be possible to use a combination of power-line and Wireless-LAN to offer broadband services. In December 2002, FCC (Federal Communications Commission) data indicated that there were 548 000 fibre connections, 276 000 satellite and fixed wireless connections and 1.2 million broadband connections under other wireline, most of which were for business users.⁸⁷

The NTCA say that while still a new business, cable telephony is a key component of the cable industry's future business strategy. They believe that with the continued improvements in IP telephony, cable-delivered telephone service could evolve into a simple telecommunications after-thought of consumers, rather than a separate, independent service.⁸⁸ For their part, ILECs will be increasingly driven to supply broadband access to fill the gaps appearing in other revenue streams [*e.g.* wireless and VoIP substitution for fixed network telephony, DSL substitution for additional telephone lines, and possibly WLAN (Wireless Local Area Network) substitution for a variety of services].

NOTES

- ¹ See for example the Road Runner service in New York. <http://www3.twnyc.com>
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provides cable television, high-speed cable Internet access and telephony services to customers across Japan. The number of serviceable households ("homes passed") in J-COM Broadband franchises in Hokkaido, Kanto, Kansai and Kyushu is approximately 5.8 million (December 2002).

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