Universal Service: providing voice telephony to remote users - an international review

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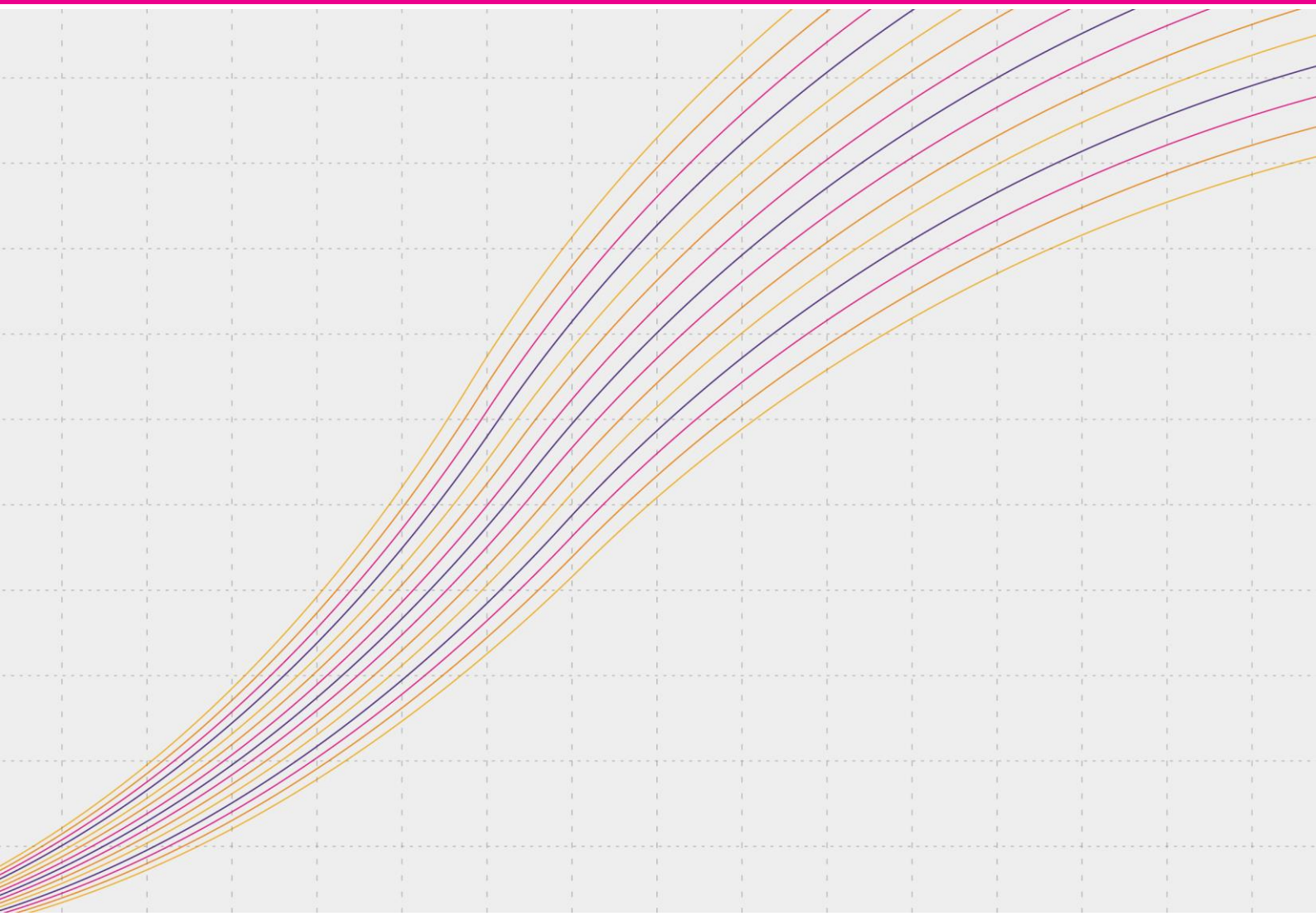

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About Plum

Plum offers strategy, policy and regulatory advice on telecoms, spectrum, online and audio-visual media issues. We draw on economics and engineering, our knowledge of the sector and our clients' understanding and perspective to shape and respond to convergence.

About this study

This study reviews universal service policy in a set of case study countries. It considers the services provided to consumers and the mechanisms for the provision and funding of those services.

Contents

Summary

The case study countries vary considerably in terms of universal service policy and its implementation especially where it concerns the delivery of voice telephony to remote areas. For example, they vary in terms of:

- the scope and geographic reach of universal service;
- the extent to which mobile and satellite technologies are used to deliver universal service;
- the way in which the universal service provider is appointed; and
- the way in which the net costs of universal service are funded.

The scope of universal service

The scope of universal service varies considerably from one case study country to another:

- In all EU member states the scope is defined by the Universal Service Directive which requires voice telephony services and functional Internet access at a fixed location to be available to all at an affordable price[1]. In some member states functional Internet access speeds are set at (or in excess of) 1 Mbps (e.g. Malta, Finland); in others they are not defined or set at a low level measured in kilobits per second. In such countries universal service is effectively restricted to fixed voice telephony.
- In some countries, like France, universal service is confined to fixed voice telephony with separate, government funded, initiatives being used to encourage rollout of broadband in rural areas. In others, such as Canada and Croatia, universal service is defined so as to include both voice telephony and broadband.
- Canada and the Kingdom of Saudi Arabia (KSA) also include within universal service requirements to deliver services on the move as well as services at a fixed location.
- In some countries there are now moves to drop voice telephony from the scope of universal service. For example:
  - In Latvia, the US provider is Lattelecom (Latvia's monopoly fixed telephony operator). One of its obligations was to make the PSTN available to anyone in the country wishing to make use of communications services. Latvia's broadband market is also very developed. In 2016, the Latvian regulator SPRK added a USO amendment according which – If a service was provided by the market – it would no longer be included as a universal service. According to 2017 BEREC report[2], Latvia has removed fixed telephony services from the scope of universal service obligations.
  - At the end of 2017, the Portuguese regulator – ANACOM[3] – recommended the State to terminate its fixed telephone universal service contract with the US provider NOS: This recommendation was made based on the lack of demand (only 2 customers since the beginning of the contract between

[1] Note that we exclude directory services, payphone services and services for the disabled from our analysis here.
[2] https://berec.europa.eu/eng/document_register/subject_matter/berec/others/6973-berec-update-survey-on-the-implementation-and-application-of-the-universal-service-provisions-a-synthesis-of-the-results
[3] https://www.anacom.pt/render.jsp?contentId=1423190&languageId=1

NOS and the State in 2014) and considering that the objectives underlying the supply of universal services are met by the market on a competitive basis.

The geographic reach of universal service

There is general agreement that universal service should, in principle, involve the delivery of a core service to everyone in each case study country at an affordable price. But in practice this does not mean that universal service is available to absolutely everyone. Specifically:

- In the UK there is an explicit mechanism for excluding from the universal service obligation a premise which would cost more than £3400 to connect to the network unless the premise owner is prepared to pay the excess. In many cases this would make the service unaffordable.

- In the KSA, where mobile networks are used to deliver universal voice telephony, there is open acknowledgement that there is little connectivity for isolated premises which are located outside of the rural settlements served by the universal service scheme.

- The universal service directive of the EU, with which seven of the nine case study countries are required to comply, specifies quality of service standards which were designed to apply to fixed copper line based services. We understand that, at the time the Directive was last updated in 2009, the European Commission did not consider the use of mobile or satellite as appropriate technologies for delivering the universal service. So minimum quality of service standards have not been specified for such delivery. At the same time it is clear from various studies[4] that the cost of delivering universal service to 100% of premise using fixed terrestrial technologies is extremely high, even in countries with relatively high population densities.

- Recognising this fact several case study countries, notably Canada outside the EU and Greece and Sweden within it, have taken the view that the latency offered by satellite is adequate for the supply of voice telephony services. See below for a further discussion on latency. So in these countries 100% geographic coverage for the voice telephony component of universal service is possible.

- In other case study countries respondents have been unable to state with any certainty the extent to which geographic coverage of universal service for voice telephony falls below 100%. In these countries remote premises can use Ka-band satellite (at affordable prices) for voice telephony. But this service is supplied on a commercial basis rather than as part of universal service.

Use of mobile networks

The use of mobile networks to deliver the universal service varies substantially. Under a technology neutrality principle mobile networks are eligible to deliver voice universal service in the four case study countries with the lowest population density (Canada, Finland, the KSA and Sweden). This arrangement is relatively straightforward. The obligation typically falls on an operator which offers both fixed and mobile networks and the operator can choose how to supply voice telephony.

In Finland and Sweden it is our understanding that the universal service is restricted to delivery at a fixed location (in line with the European Union's Universal Services Directive). But in Canada and the KSA there is a requirement for coverage to extend outside the home to major highways. This requirement is not well defined.

[4] See for example *The impacts of a broadband USO in the UK*, Plum for the Broadband Stakeholder Group, May 2017.

We have struggled to get comprehensive information from respondents about how regulators verify that mobile networks provide an adequate universal service in the home. But we note that in Finland service is considered adequate if:

- there is one more place in the home where a mobile device offers adequate reception to make and receive voice calls; or
- users can make and receive calls after installing (at their own cost) high gain antenna to boost reception.

Verification is provided on an exceptional basis. If a user is not satisfied with their reception they may complain to the regulator who will contact the service provider and have them check the situation. In some rare cases the regulator's experts may measure coverage.

In Canada minimum quality of service standards for mobile have not been specified. Historically 99% of the Canadian population has had access to high-quality voice telephony through use of the copper loop fixed access network. So there has been little pressure to consider quality of service standards for the delivery of voice telephony over mobile networks and no such standards have been specified for universal service purposes. The CRTC currently relies on the coverage maps of the mobile operators in determining mobile coverage and does not try to validate these claims. This may well change under the new universal service regime where there is a good chance that mobile operators will start to receive universal service funding from the CRTC and the CRTC will then need to validate that the additional coverage for which the funding is provided is delivered. It is also worth noting that in Canada the new definition of the universal service objective, which requires unlimited data capacity for end users, may effectively rule out use of mobile networks in practice.

Satellite latency for voice telephony services

As discussed earlier, satellite is eligible to deliver universal service for voice telephony in Canada, Greece and Sweden. We have been unable, despite repeated requests, to get information about what is considered adequate latency in Greece. In Sweden there is no specified QoS requirement for voice delivered by satellite and hence no consideration of, or specification of, latency. Users of satellite purchase a broadband subscription and then use an IP-telephony application for voice communication. We understand that in Canada:

- There are a number of satellite-dependent communities (in which just under 50,000 of the Canadian population lived).
- Satellite backhaul is used to connect these communities to the rest of Canada.
- The latency for calls between these communities and the rest of Canada is around 400 msec.
- Voice telephony calls between members of any community is usually done using a terrestrial system and latency is not a problem.
- There is long latency, approaching 1000 msec, if someone in one satellite dependent community wants to talk with someone in another such community. But this is a rare event.
- Canada plans to replace satellite backhaul with terrestrial fibre links in the long term. But this is an expensive process given the length of the terrestrial links required and the poor weather conditions – which often allow construction for only three months of the year.

Selecting the universal service provider

There are various ways of selecting a universal service provider (USP):

- In many countries the incumbent fixed operator is appointed without any formal selection process.
- Where there is competitive tendering there is often only one credible applicant and the universal service provider is the fixed telecom incumbent (e.g. UK, Croatia, France).
- The most interesting case study countries here are Greece and Portugal, where the operator which won the tender was not the fixed incumbent. In both countries the USP selected offered to accept the lowest subsidy at auction following a technical pre-selection process.
- In Sweden the regulator is effectively the universal service provider. On our latest enquiry it had 16 customers.

Funding the costs of universal service provision

The way the net costs of being the universal service provider are met takes on a number of forms:

- In some countries there is just an industry financing of the net cost of the USO.
- In other countries such as the KSA financing comes entirely from the government.
- In the UK for the voice telephony USO, BT is the universal service provider and bears the net cost, given the regulator's judgement that the net cost is not an unfair burden after taking account of the intangible benefits which the universal service provider enjoys. These intangible benefits include the marketing advantage of being able to offer ubiquitous access and the possibility that currently unprofitable customers will, over time, become profitable.
- In Canada there is parallel funding of the net cost through an industry fund (administered by the regulator) and various federal, provincial and local government funding arrangements.

Affordability

All universal service policies in the case study countries specify provision at an affordable price to end users. This is generally interpreted to mean the price for the corresponding service in competitive markets. (There are in addition, special tariff packages which are aimed at those on low incomes. These are excluded from our analysis). Where the affordable price is too low for commercial rollout this creates net costs. These fall into one of two categories:

- The operating revenues are greater than the operating costs, but the difference does not justify the capital expenditure required for network rollout. As a result, a one-off subsidy is required to stimulate investment. This is the situation for most of the current high-speed broadband rollout required under universal service policies.
- The operating revenues are less than the operating costs and an on-going subsidy is required. This is the case in Canada for example with satellite broadband access.

1 Introduction

1.1 Objectives of the study

The objectives of the study are to:

- investigate how countries other than Australia are addressing the development of universal services;
- focus on the provision of voice telephony services to the most remote premises in these other countries; and
- inform Telstra's thinking and contribution to the design of a rational and effective Universal Service Guarantee – a concept which is now being developed by the Australian Government.

The focus of the study is to establish, for selected case study countries, how voice telephony services are provided to the most remote premises within the country under its universal service policy. This normally, but not always, involves the appointment of a universal service provider.

The study excludes consideration of:

- how the net costs of the USO are calculated or funded;
- how affordability issues are resolved (although we will enquire as to the prices charged for voice telephony delivery under the universal service); and
- universal services other than voice telephony and broadband (e.g. provision of payphones, services for the disabled, directory services).

1.1 Scope of the study

1.1.1 Selected case studies

The following countries have been selected for case study:

- Canada – a country with a very similar population density to Australia;
- Croatia – the only country in Europe (as far as we have been able to determine at this time) where a tendering process has been followed and where broadband has been added explicitly to the definition of universal service;
- Finland – a low population density country, where we have recently carried out research on the development of universal service policy, and where universal service is underpinned by a nationwide 450 MHz wireless terrestrial network;
- France – a country where the universal service provider has been appointed through a competitive tendering process;

- Greece and Portugal – countries where the universal service provider has been appointed through a competitive bidding process and where the winner was not the incumbent fixed operator;
- Saudi Arabia – where three universal service providers have been appointed following a competitive tendering process;
- Sweden – another low population density country, where the regulator has looked explicitly at the problem of serving the most remote rural locations with voice telephony;
- UK – where universal service arrangements are currently under review, where there is a high level of debate in the public domain, and where Plum has been centrally involved.

In terms of methodology, the selected case studies have been prepared based on:

- desk research;
- our existing knowledge of universal service arrangements in the case study countries; and
- email exchanges with relevant contacts in the regulator and universal service provider, for specific complementary discussions.

1.1.2 Universal Service in the European Union

Seven of the nine case studies refer to European Union members, where Universal Service requirements must meet the requirements of EU law. Universal Service in the EU "*refers to the set of general interest demands to which services such as telecommunications and the mail should be subject throughout the EU. The aim is to ensure that all users have access to quality services at an affordable price.*"[5]

The existing legislative framework for telecommunications in the European Union was largely set up in 2002[6] and amended in 2009[7]. The 2002 directive aims to guarantee the availability of a minimum set of good quality electronic communications services, which all users should be able to access at an affordable price. It stipulates obligations on the supply of universal services (e.g. ensuring that "*electronic communications services of a specified quality and at an affordable price are available to all users in their territory, regardless of their geographical location*"), companies providing them (e.g. the need for operators to provide transparent and timely information on prices and tariffs), as well as the rights of end-users (e.g. to change fixed or mobile operator in one day, while keeping the same phone number).

On 14 September 2016, the European Commission proposed[8] the European Electronic Communication Code in order to take into account technological developments and evolving consumers demands and to stimulate investment (to reach the 2025 EU connectivity target objectives). This Code overhauls the existing legislative framework for telecommunications in the EU. Its provisions include measures on the Universal Service regime.

The proposal is designed to update the 2002 Universal Service Directive by removing from its scope legacy services (such as public payphones and user directories) and focusing instead on basic universal service broadband. Under this proposal:

- "Universal service will be defined by a list of online services which use the broadband connection: Broadband will be defined by referring to a functional internet access connection which can deliver a

[5] http://eur-lex.europa.eu/summary/glossary/universal_service.html
[6] Directive No. 2002/22/EC: http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1478852144805&uri=CELEX:02002L0022-20160430
[7] Directive No. 2009/136/EC of 25 November 2009: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32009L0136&from=FR
[8] Proposal available on: https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A52016PC0590

minimum list of online services which enable end-users' participation in civil society. Member States can then refine this definition at the national level."

- "Member State intervention should be concerned primarily with the affordability of these services: Affordability should be ensured for these services provided at a fixed location, but Member States have the possibility to include affordability measures for mobile services for the most vulnerable end-users' where lack of such affordability is demonstrated."

- "Under the code, Member States will be obliged to ensure that all end-users have affordable access to functional broadband as well as voice communications, at least at a fixed location. They are empowered to demand that undertakings provide special tariffs for vulnerable users (those with low income or special social needs) "

- Availability of these services will be primarily promoted by other policy tools (incentives to private investment, state aid, spectrum-related coverage obligations, etc.). They should be provided under a universal service obligation only if the social and economic case for providing them in this way can be made. Taking into account the broad range of beneficiaries (beyond the telecom sector) of universal broadband supplied in this way, this option should rely on government financing though the general budget rather than industry funding. This offers a more equitable and less distortive way of funding the provision of universal service.

Finalisation of this legislation is currently in progress[9] (The Estonian presidency has been mandated to commence trilogue negotiations on the Code).

[9] More information available on: http://www.europarl.europa.eu/legislative-train/theme-connected-digital-single-market/file-electronic-communications-code; http://www.europarl.europa.eu/RegData/etudes/BRIE/2016/593562/EPRS_BRI(2016)593562_EN.pdf

2 Canada

2.1 The Canadian telecommunication industry

There are two main sets of facilities-based operators in Canada:

- the large incumbent local exchange carriers (ILECs) which generate 59% of Canadian telecommunications revenues). These carriers serve relatively large geographical areas, usually including both rural and urban populations, and provide wireline voice, Internet, data and private line, wireless, and other services. The large incumbent providers are Bell Aliant; Bell Canada; MTS Allstream; Northwestel, SaskTel; Télébec, and TELUS; and

- the cable-based carriers which account for a further 33% of telecommunications revenues. Cable-based carriers are the former cable monopolies that also provide telecommunications services (e.g. wireline voice, Internet, data and private line, and wireless services). These providers include such companies as Bragg, Cogeco, Rogers, Shaw, and Videotron.

Both groups provide mobile services – which generate around 50% of total telecommunications revenues. Approximately 90% of Canadian mobile phone users subscribe to one of the three largest national telecommunication companies (Rogers Wireless, Bell Mobility, and Telus Mobility) or one of their subsidiary brands.

Figure 2.1: Comparative table of country statistics as at the end of 2016[10]

Metric	Australia[11]	Canada
Demographics and economic indicators		
Population (000)	24,126	36,290
Household density per km^2	1.2	1.4
GDP per capita (PPP $)	46,012	44,644
Telecoms indicators		
Mobile subscribers per hundred population	110	85
Fixed telephone lines per hundred households	89	110
Fixed broadband connections per hundred households	80	97
2G coverage (% pop)	99.3%	99.4%
3G population coverage (% pop)	99.3%	99.4%
LTE/WiMax coverage (% pop)	98.0%	98.5%

Figure 2.1 compares key indicators in Canada with corresponding indicators in Australia. It shows that:

- the telecommunication sector in Canada is at a similar level of development to that in Australia; and

[10] See Appendix A, Figure A.1 for more indicators on both countries.
[11] Australia coverage has evolved since 2016: 2G has largely been switched off, 3G coverage is now at 99.4% and 4G coverage at 99%.

- Canada faces similar challenges in implementing universal service objectives in terms of its low population density.

However, the Canadian sector is organised on a more regional basis with (arguably) stronger competition between wireline telecommunication operators and wireline cable TV companies. In addition, there have been no similar initiatives in Canada to develop an equivalent of NBNCo.

2.2 Universal service policy to 2011 – fixed voice services only

Up until 2011 Canada's universal service policy was based on achieving a basic service objective. This required the ILECs in each region of Canada to offer unlimited free local calling, access to long-distance voice telephony services and low-speed data via wireline services at an affordable price[12]. In other words where there are net costs in providing the basic fixed voice telephony service provided in low-cost areas, a monopoly fixed supplier is entitled to claim from the universal service fund. The affordable price varies from location to location, but essentially it was the same price as that offered to end users in competitive areas[13]. In practice the price is now around CAD$30 per month. The ILECs are required to offer service to:

- existing customers;
- new customers premises where there are existing facilities (copper loops) available; and
- new customers at premises where there are no existing facilities – unless the general tariff conditions of the ILEC exclude such provisions. For example, Bell Canada's general tariff conditions state that:

  "*The Company is not required to provide service to an applicant where [...] the Company would have to incur unusual expenses which the applicant will not pay; for example, for securing rights of way or for special construction;*"[14]

To meet the basic service objectives for fixed voice telephony in high cost service areas, the telecommunications regulator – the CRTC (Canadian Radio-television and Telecommunications Commission) – gave the ILECs a total subsidy of around CAD$100 million per annum to cover the net costs (costs less revenues) of meeting these requirements. This money was raised from an industry levy on all operators with revenues greater than CAD$10 million each year.

2.3 Universal service – 2011 to 2016 – 5 Mbps broadband added

In 2011 universal service policy was expanded so that a universal service objective replaced the basic service objective. This meant adding broadband to fixed voice telephony and specifying a target minimum speed of 5 Mbps downstream and 1 Mbps up. However, the available CRTC subsidy did not change. During this period operators looked to government for subsidy to roll out broadband services to meet the new universal service objective in areas where deployment was not commercially viable. Subsidy programs were (and continue to be) available from federal government, provincial government and local government. At the provincial level for example:

[12] See *Telecom Regulation Policy CRTC 2016-496,* Para 5
[13] Areas in which the ILEC faces competition from one or more other wireline operators and one or more independent mobile operators
[14] *Bell Canada General Tariff CRTC 6716,* August 2017

- In 2002, the "Villages branchés du Québec" program funded CAD$75m to provide schools, boards of education, professional training centres, libraries and municipalities in Québec with broadband. Once the project had been selected, 75% of admissible expenses were subsidised.

- The "Québec branché"[15] program was created in 2017 by the Québec government to connect citizens and businesses from rural and remote areas to broadband at a price comparable to that charged in urban areas. More than 340,000 households are considered as being badly connected. An area is considered as rural if there are fewer than 30,000 inhabitants and an internet connection is considered as broadband if it offers download speed of at least 5Mbps and upload speed 1Mbps, and a monthly transfer capacity not below the average Canadian consumption. This program focuses on the access network and is complemented by the "Brancher pour innover" program which focuses on backbone networks and is funded by federal government.

By the end of 2015 close to 98% of premises in Canada had access to broadband at or better than the target speeds and the Government decided to raise the targets.

2.4 Universal service policy from 2017 onwards – high-speed broadband added

After consulting on the idea of higher broadband speeds the CRTC set out its decision at the end of 2016[16]. The new universal service objective is now as follows:

"Canadians, in urban areas as well as in rural and remote areas, have access to voice services and broadband Internet access services, on both fixed and mobile wireless networks. To measure the successful achievement of this objective, the Commission has established several criteria, including,

- Canadian residential and business fixed broadband Internet access service subscribers should be able to access speeds of at least 50 megabits per second (Mbps) download and 10 Mbps upload, and to subscribe to a service offering with an unlimited data allowance; and

- the latest generally deployed mobile wireless technology should be available not only in Canadian homes and businesses, but on as many major transportation roads as possible in Canada".

The CRTC decision has changed the universal service objective and the way it is funded in four main ways:

- it has raised broadband speeds from 5/1 to 50/10 Mbps;

- the new broadband speed target applies to all premises;

- CRTC funding will be doubled and the CRTC will choose between competitive bids rather than simply giving the money to the ILECs; and

- universal service will be expanded from fixed services to fixed and mobile services (with mobile coverage at home and along major highways).

The speed targets set in the 2016 decision are deliberately ambitious. The CRTC expects that they will be met for 90% of the population by 2021 but that it will take until 2036 to achieve these targets for the whole population. In the meantime, the CRTC anticipates incremental progress towards the targets with:

[15] https://www.economie.gouv.qc.ca/fileadmin/contenu/programmes/aide_financiere/quebec_branche/quebec_branche_complement_info.pdf
[16] *Telecom Regulation Policy CRTC 2016-496*, December 2016

- major technology improvements closing the gap on the targets very substantially over the next 18 years; and

- a combination of subsidy programs from the Government and the CRTC helping to stimulate rollout in high cost service areas. In particular the criteria for using the CRTC's fund will allow for companies to apply for funds to make significant incremental improvements towards the broadband speed targets without necessarily meeting them immediately.

The new regime is focussed on the universal provision of high-speed data services where voice telephony can be regarded as an application (subject to additional requirements to provide emergency service access). Here the CRTC is in the process of agreeing quality of service standards. The Network Working Group of the CRTC published a report on these standards in November 2017[17] which will provide input to an eventual decision by the Commissioners of the CRTC. Within this report the main operators suggest a round-trip latency of less than 750ms for voice telephony and video calling and a round-trip latency of less than 200ms for real-time gaming or remote surgery. Other stakeholders propose lower latency standards.

2.5 CRTC funding under the new universal service objective

The CRTC currently raises around CAD$100 million each year from the telecommunications industry to subsidise wireline voice telephony services in high cost areas. This fund will be increased over the next four years to a cap of CAD$200 million per annum to support the new universal service objective of 50 Mbps broadband for everyone. The CRTC does not know what net costs achieving the new universal service objective will generate. It has instead set a cap on what it is prepared to pay. At the same time the payments to the ILECs will be phased out. 10% of the new fund will go to supporting better services for satellite dependent communities (see below).

Use of the fund will be administered by a third party rather than by the CRTC and will be coordinated with government funding. The CRTC fund will focus on subsidising underserved areas. This simply means areas where broadband does not meet the 50/10 Mbps speed targets.

Applicants for the new fund will be selected on a competitive basis according to criteria set by the CTRC. CRTC has consulted on the process for selection of projects and set out its preliminary views in April 2017[18]. It is now in the process of making a final decision on the funding mechanism. The CRTC proposes that applications will be assessed on 14 criteria as set out in Appendix 1 to CRTC 2017-112. An attractive application will offer higher broadband speeds, quality of service and data caps, provide mobile as well as fixed capability, have already attracted government and/or private investment, offer wholesale access to third parties, propose a speedy implementation to a large number of households in under-served areas at low end-user prices, and require a low subsidy per household from the CRTC.

2.6 The role of satellites in achieving universal service

There are satellite dependent communities (SDCs) which rely entirely on satellite communication for voice and data services – mainly in the north-west of Canada. Communities range in size from 100 to 3000 people and around 45,000 people in total (0.15% population) live in these communities[19]. Typically, satellites[20] provide the backhaul from each community to the core networks and terrestrial technologies (which are typically based on

[17] CRTC Interconnection Steering Committee Network Working Group Develop recommendations as to the appropriate metrics and reporting to define high-quality fixed broadband Internet access service, Non-Consensus Report, Task NTTF036 (TIF 36) Report NTRE061, November 29, 2017.
[18] *Telecom Notice of Consultation CRTC 2017-112, Development of the Commission's broadband funding regime*, CRTC, April 2017
[19] *Satellite Inquiry Report*, CRTC, October 2014
[20] Originally GEO satellites using C-band and now Ka-band

copper loops or terrestrial wireless links) are used to connect community members to each other and to the local earth-station.

There are in addition a small number of isolated premises which use direct-to-home satellite links for all their voice and data calls. Satellite typically introduces a delay of around 400 msec. So a double hop voice call between an end-user in one SDC and an end-user in another SDC could experience latency close to 1000 msec. But this is rare. In most cases the households within each community call each other over the terrestrial network or they call end-users on the terrestrial network in the rest of Canada, in which case latency is close to 400 msec.

The people in the SDCs want the same quality of service (and especially latency[21]) at the same price as Canadians living in urban areas. But it will take a long time to achieve this. Building terrestrial links from these communities to the core networks is expensive given the distance involved. At the same time the construction season is short – typically three months in the north of Canada. In the meantime, there is now the possibility of low earth orbit satellites solving the latency problem. But even low earth orbit satellites will not deal with the throughput problem – the universal service objective is to give everyone unlimited data access while satellite data capacity is limited and expensive to expand.

2.7 The role of mobile in achieving universal service

The new universal service objective requires the rollout of mobile services along the main highways as well as providing population coverage to people in and around their homes. But the minimum quality of service standards for mobile have not been specified. Historically 99% of the Canadian population has had access to high-quality voice telephony through use of the copper loop fixed access network. So there has been little pressure to consider quality of service standards for the delivery of voice telephony over mobile networks and no such standards have been specified for universal service purposes. The CRTC currently relies on the coverage maps of the mobile operators in determining mobile coverage and does not try to validate these claims. This may well change under the new universal service regime where there is a good chance that mobile operators will start to receive universal service funding from the CRTC and the CRTC will then need to validate that the additional coverage for which the funding is provided is delivered.

Mobile networks can be used to meet the new minimum broadband speeds instead of using wireline technology, given that the Telecommunications Act requires technology neutrality on this point. But one requirement of the new universal service objective is that the provider must offer unlimited data. Given the contended nature of mobile networks, this makes universal service via mobile challenging. It is possible that 5G technologies might meet this challenge.

2.8 Key findings

Universal service mechanisms in Canada are in transition from a system in which the ILECs are given subsidy to provide basic wireline voice telephony in high cost areas to one in which the subsidy is provided through a competitive bidding process to supply high-speed broadband connections with voice telephony capability. The evaluation criteria are set out in Section 2.5 above.

The minimum download broadband speed of 50 Mbps for all, with unlimited data, is ambitious and the CRTC does not expect this target to be met for the last 10% of the population before 2036.

It is difficult for mobile networks rather than wireline networks to be used to meet this new universal service objective given the requirement for unlimited data.

[21] Currently around 400ms

A small proportion of the Canadian people (less than 0.2%) live in remote satellite dependent communities. The long-term aim is to connect these areas to the rest of Canada using terrestrial links so as to get latency down to urban levels. But the CRTC recognises that this is a long-term ambition rather than an immediately achievable goal.

3 Croatia

3.1 Overview

Croatia has been included in the case studies because it is the only country in Europe where a tendering process has been followed and where broadband has explicitly been added to the definition of universal service. In practice it is proved more difficult to find relevant written material and helpful contacts in Croatia than in the other case study countries. But we leave Croatia in the report in case the material we are able to provide is of use to Telstra.

Croatia lags somewhat behind the rest of Europe in terms of 4G and NGA coverage, particularly in rural areas. In part this is due to the fact that much of the spectrum harmonised at the EU level for wireless broadband has yet to be assigned. The incumbent operator, HT, maintains a strong market position in both fixed and mobile markets, with just short of 50% share in each.

In Croatia, Universal Service is defined as *"the smallest set of electronic communications services of a certain quality that must be available to all end users at an affordable price in the entire territory of the Republic of Croatia regardless of their geographical location and with the least possible degree of distortion of competition"*[22].

Former monopoly HT (Hrvatski Telekom) – as the Croatian universal service provider - is required to fulfil the following requirements under the EU 2009 Universal Services Directive, including support to "*functional Internet access as well as voice telephony*". HT is the largest operator both in broadband (56.9% market share) and in mobile (46.7% market share). It is 51% owned by Deutsche Telekom and adopted the T-Com (for fixed line) and T-Mobile (for wireless) brands in 2004 to match branding of Deutsche Telekom.

[22] Source: 2016 Annual Activity Report, Croatian Regulatory Authority for network Industries, June 2017

Figure 3.1: Comparative table of country statistics as at the end of 2016[23]

Metric	Australia[24]	Croatia
Demographics and economic indicators		
Population (000)	24,126	4,213
Household density per km^2	1.2	40.1
GDP per capita (PPP $)	46,012	23,422
Telecoms indicators		
Mobile subscribers per hundred population	110	105
Fixed telephone lines per hundred households	89	63
Fixed broadband connections per hundred households	80	46
2G coverage (% pop)	99.3%	100.0%
3G population coverage (% pop)	99.3%	99.1%
LTE/WiMax coverage (% pop)	98.0%	96.9%

3.2 The provision of the voice telephony universal service and broadband universal service

Universal service operators appointed by HAKOM (Croatian Regulatory Authority for Network Industries) have the obligation to cover the territory of the Republic of Croatia for four years.

HT – the fixed incumbent operator – has been appointed, following a competitive tendering process in 2010, then again in 2015, for the following services:

- access to a public communications network and publicly available telephone service at a fixed location;
- installation of public pay phones or other publicly available access points for the public voice service on public places available at any time;
- special measures for disabled persons, including access to emergency services, access to directory enquiry service containing subscriber number and to the subscriber directory in the same manner as for other end users of services; and
- special tariff systems adjusted to socially disadvantaged groups of end users of services.

HAKOM manages the universal service fund – based on a mechanism of recovery of net costs – that is financed by all operators of publicly available telephone services with share in total revenue on national retail markets for publicly available telephone services exceeding 2%.

[23] See Appendix A, Figure A.1 for more indicators on both countries.
[24] Australia coverage has evolved since 2016: 2G has largely been switched off, 3G coverage is now at 99.4% and 4G coverage at 99%.

3.3 The roll-out of universal broadband

Croatia's new Universal Service Ordinance (in 2013) extended the scope of Universal Service Obligation to internet access at a minimum speed of 144kbps. As from January 2015, the Universal Service Provider has had an obligation to provide data communications at a minimum speed of 1 Mbps: HT is required to propose a special package meeting this minimum speed requirement to users not covered by the regular internet services.

Several public initiatives have been launched to bring broadband to underserved areas.

- In 2013, under the government umbrella, seven national companies[25] started pooling their existing fibre-optic transmission network assets with the potential to cover 75% of the country with high speed services, with the objective to develop shared fibre backbone networks stretching to rural areas. The combined infrastructure is managed by the public transmission company OiV[26], which then offers fibre capacity wholesale to private and public operators that are eligible for EU funding when expanding broadband access to remote areas.

- In 2017, a similar initiative was approved by the EC (a EUR101.4 million-scheme by the government of Croatia) to cover Croatian underserved rural areas with shared broadband infrastructure. Network ownership would remain public (via OiV) and financed by the European Regional Development Fund (and partly by national funds). This scheme should be completed by 2023 and aims to increase the coverage of high speed broadband and provide symmetrical speeds of 100Mbps.

- Separately, HAKOM has conducted a number of tenders offering state aid to companies which commit to rolling out broadband networks in remote areas. Winners of the contracts have included HT, H1 Telekom, VIPnet and Pro-Ping.

3.4 The role of the mobile networks

Mobile market is high-growth and competitive in Croatia. It is shared between HT (Hrvatski Telekom, formerly T-Mobile Croatia) with 46,7% of market share, VIPnet (Telekom Austria Group) with 35,8%, and tele2 Croatia (17,5% market share). We also note that 97% of the population enjoyed access to 4G services at the end of 2016.

As far as we know, mobile networks are not used to meet universal service obligations in Croatia.

3.5 Key findings

Universal service is industry-funded in Croatia. Broadband has been included in Universal service Obligations, at a minimum speed of 1 Mbps (since 2015).

Public initiatives have been conducted to bring it to remote areas, including shared infrastructure projects.

[25] Power utility Hrvatske Elektroprivrede (HEP), rail operator HZ Infrastruktura, national highways agency Hrvatske Ceste (HC), motorway operators Hrvatske Autoceste (HAC) and Autocesta Rijeka-Zagreb, crude oil transportation company Jadranski Naftovod (JANAF) and natural gas transmission operator Plinacro

[26] OiV: Odasiljaci i Veze

4 Finland

4.1 Overview

Finland has a highly developed mobile market with almost 100% 4G coverage. Fixed NGA coverage is somewhat less developed, in part because fixed wireless options are a much more popular means of delivering broadband in rural areas. The Finnish market is dominated by three major players: Elisa, Telia Finland (until 2017 known as Sonera) and DNA, which supply both fixed and mobile services.

In Finland, consumers and businesses are entitled to a reasonably priced and functional voice telephone connection to their permanent place of residence or place of business.[27] Since 2010, they have also been entitled to broadband access at speeds of at least 1 Mbps at a "reasonable price". In 2015 the minimum speed requirement was doubled to 2 Mbps.[28,29] There are plans to increase this requirement to 10 Mbps by 2021.

In addition, consumers with speech and hearing impairment are entitled to a symmetric connection of 512 kilobytes per second (to allow videoconferencing) and text messaging services.

The national communications regulator, FICORA, has adopted a technology-neutral approach to the provision of universal services, with a few exceptions: satellite is not considered eligible for universal service provision either voice or broadband services, and VoLTE/VoIP services are not considered when assessing availability of the voice service.[30] However, mobile services can supply the voice universal service, and fixed wireless solutions can supply the broadband service.

[27] https://www.viestintavirasto.fi/en/internettelephone/righttoatelephoneandbroadbandsubscription.html

[28] European Parliament (2016), *Broadband as a Universal Service*, Briefing, http://www.europarl.europa.eu/RegData/etudes/BRIE/2016/581977/EPRS_BRI(2016)581977_EN.pdf

[29] Technically, the average minimum download speed must be at least 1.5 Mbps over a 24-hour period and at least 1 Mbps during any 4-hour period. See: https://www.viestintavirasto.fi/attachments/muutpaatokset/Yleispalvelupaatosten_perustelumuistio_2016.pdf p12. (Finnish)

[30] This is over concerns about the ability to locate the source emergency calls over VoIP. See http://www.112.fi/hatatilanne/uusi_tekniikka (Finnish). This concern is shared by other NRAs, some of whom are doing work on improving caller location information for VoIP services. For example, see https://www.ofcom.org.uk/about-ofcom/latest/bulletins/competition-bulletins/open-cases/cw_996

Figure 4.1: Comparative table of country statistics as at the end of 2016[31]

Metric	Australia[32]	Finland
Demographics and economic indicators		
Population (000)	24,126	5,503
Household density per km^2	1.2	6.6
GDP per capita (PPP $)	46,012	43,346
Telecoms indicators		
Mobile subscribers per hundred population	110	134
Fixed telephone lines per hundred households	89	18
Fixed broadband connections per hundred households	80	69
2G coverage (% pop)	99.3%	100.0%
3G population coverage (% pop)	99.3%	99.9%
LTE/WiMax coverage (% pop)	98.0%	99.9%

4.2 The provision of the voice telephony universal service and broadband universal service

In areas with insufficient commercial supply of universal service-grade products, FICORA – the national communications regulator – designates a universal service provider (USP) for the area. Telecoms operators supply FICORA with information on the availability of services at the postcode-level. On the basis of this information, FICORA decides which postcode areas are eligible areas for each universal service. This exercise was last undertaken in 2016.[33,34]

FICORA then invited operators to volunteer to provide universal service in each area. No operators volunteered to provide the voice telephony service; Elisa Oyj volunteered to provide the broadband service in four areas.

For the remaining areas, FICORA designated a universal service provider according to a three-step procedure.

- First, operators' financial status was assessed by looking at the operators' debt levels and profitability, to assess its capability for providing the service.
- Second, the extent of operators' networks was assessed to consider which operator might be able to deliver universal service in a given area most cost-effectively.
- Third, other factors were considered, including the impact on competition and the burden of the obligation. FICORA's approach is to try to share the obligation between operators to minimise the distortionary effect on competition, and to balance the burden of universal service provision. FICORA also considers other

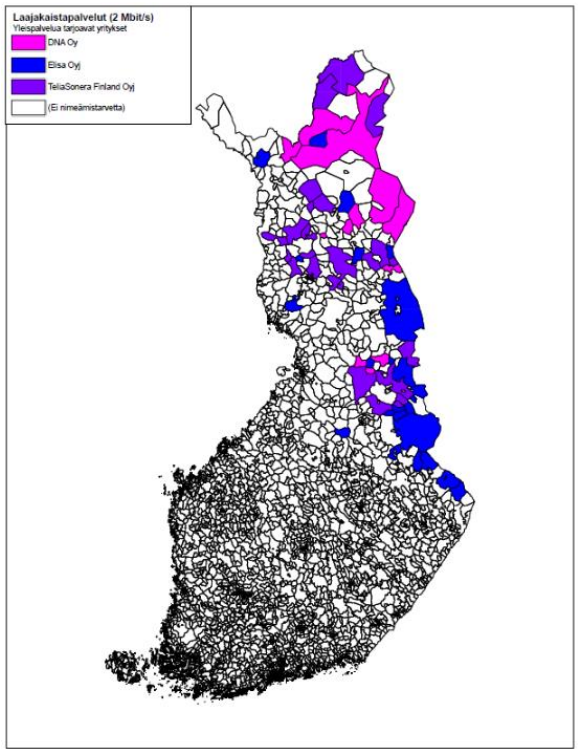
[31] See Appendix A, Figure A.1 for more indicators on both countries.
[32] Australia coverage has evolved since 2016: 2G has largely been switched off, 3G coverage is now at 99.4% and 4G coverage at 99%.
[33] https://www.viestintavirasto.fi/attachments/muutpaatokset/Yleispalvelupaatosten_perustelumuistio_2016.pdf (Finnish)
[34] See maps at https://www.viestintavirasto.fi/attachments/muutpaatokset/Yleispalveluyritykset_05102016_karttakuvat.pdf

factors which may improve the cost-effectiveness of service provision – for example, it has designated the same provider for both voice and broadband services in a given area.

As of 2016, responsibility for delivering universal voice and data services is split between three operators: DNA Oy, Elisa Oyj, and Telia Finland Oyj. Consumers and businesses in universal service areas then have the right to request service from the relevant operator.

Any technology can be used to deliver the voice service except VoIP services and satellite. Satellite services are excluded on the grounds that emergency calls made by satellite do not have emergency call priority on the telephone network. Similarly, any technology can supply the data universal service except satellite, due to the satellite requiring an unobstructed view in a certain direction, and concerns about the reliability of satellite broadband in adverse weather conditions.

Figure 4.2: Designated Universal Service Providers for the 2 Mbps broadband service, by area



The USP can charge the consumer for installation and "reasonable" expenses for construction, though these "*must be at such a level that residential customers can obtain the subscription*".[35] Similarly, monthly fees must be "reasonable", and FICORA compares these to the general price level of commercial services. FICORA does not provide recommendations on reasonable pricing and expenses but supervises the provision of universal service and steps-in on a case-by-case basis if it deems it necessary.[36] The last time FICORA intervened in this manner was in 2016.[37]

By law, a universal service provider can apply to be reimbursed by the State if the provision of universal service is deemed to impose an unreasonable economic burden on the company. This will take into account:

[35] https://www.viestintavirasto.fi/en/ficora/news/2010/P_26.html
[36] https://www.viestintavirasto.fi/en/steeringandsupervision/universalservice.html
[37] This occurred in an extremely remote area of Finland (Northern Lapland). FICORA negotiated with the local fixed telephone network operator, after which the end user price was marked down from €47 to €25.

- the size of the company;
- the quality of business;
- turnover of the relevant service; and
- any other items comparable to those mentioned in the prior points.[38]

It is not clear whether any designated provider has applied to be reimbursed.

If an end user lives in area where FICORA has not designated a universal service provider, that end user is still entitled to universal service. In such cases FICORA finds out which operator has the best capability to offer universal service. If the operator will not offer universal service voluntarily FICORA will designate the operator to offer universal service.

4.3 The roll-out of universal broadband

The Fast Broadband project was launched in December 2008 by Government. The aim is to deploy 100 Mbps broadband to 99% of users and will run until the end of 2019. €130m of public money was made available for the project. The project is administered by FICORA. Market analysis is undertaken to ensure that the granting of public aid does not distort the market situation.

As of 2016, roughly 52% of Finnish households have access to a fast broadband connection of 100 Mbps. The supply rate of fast broadband using fibre-optic technology is approximately 31%. 58% of households can access broadband speeds of 30 Mbps or more.[39]

The Fast Broadband project is not explicitly tied to the provision of universal service. However, the expansion of fast broadband service coverage in sparsely-populated areas has led to a reduction in the number of areas eligible for universal service provision.[40]

4.4 The role of the mobile networks

Mobile services can be used to supply the voice universal service. The right to a universal service is fulfilled if the user is be able to use the mobile connection at least in one spot at home or place of business. To achieve this, the user may need to improve the reception by connecting an additional antenna to a mobile router or GSM desk phone. The end user bears the costs of improving the connection. Verification is on an exceptions basis. If a user is not satisfied with their reception they may complain to the regulator who will contact the service provider and have them check the situation. In some rare cases the regulator's experts may measure coverage.

Similarly, fixed wireless solutions can supply the broadband service, provided they can deliver speeds of 2 Mbps to at least one part of the consumer's premises. (The average minimum speed must be 1.5 Mbps over a measurement period of 24 hours, and 1 Mbps over any measurement period of 4 hours.) Verification is on an exceptions basis reliant upon the end-user raising a complaint with the regulator.

[38] See https://www.viestintavirasto.fi/attachments/muutpaatokset/Viestintaviraston_paatos_yleispalveluyritysten_nimeamisesta_yleisten_puhelinpalveluiden_tarjontaan_UUSI.pdf (Finnish)
[39] Supply maps are available here: https://www.viestintavirasto.fi/en/statisticsandreports/reviewsandarticles/2017/supplyoffastbroadbandinfinland.html
[40] https://www.viestintavirasto.fi/en/ficora/news/2016/everyoneisentitledto2mbpsinternetconnection.html

4.5 Key findings

Finland's (largely) technologically-neutral approach to the provision of universal service has helped limit the geographic scope of the universal service obligation. This approach is helped by the fact that fixed telephony use is relatively low in Finland, with many users reliant solely on mobile telephony.

FICORA's designation of universal service providers for each eligible area has helped to spread the cost of supplying universal services among operators. This has helped to ensure that being a universal service provider is not overly burdensome for any single operator, obviating the need for a universal service fund. Giving operators some latitude in installation charges and service pricing may also have helped in this regard.

5 France

5.1 Overview

According to the European Commission, France has achieved 100% fixed broadband coverage. In contrast, as figure 5.1 shows, France is lagging behind many other case study countries in the roll-out of 4G mobile services. The vast majority (99%) of fixed broadband subscriptions are bundled with a telephone line. The French market is strongly competitive, with four major players providing both fixed and mobile services – with the former incumbent, Orange, having the strongest position (40% market share in fixed, 34% in mobile).

Since 2005, ARCEP – the French regulator – has been responsible for universal service, including the universal voice telephony service. France does not include broadband and very high broadband in the scope of its universal services, but in 2013 implemented the "France Very High broadband plan" with the objective to cover the whole population.

Figure 5.1: Comparative table of country statistics as at the end of 2016[41]

Metric	Australia[42]	France
Demographics and economic indicators		
Population (000)	24,126	64,721
Household density per km^2	1.2	49.5
GDP per capita (PPP $)	46,012	41,343
Telecoms indicators		
Mobile subscribers per hundred population	110	104
Fixed telephone lines per hundred households	89	145
Fixed broadband connections per hundred households	80	103
2G coverage (% pop)	99.3%	99.0%
3G population coverage (% pop)	99.3%	99.0%
LTE/WiMax coverage (% pop)	98.0%	90.0%

5.2 The provision of the voice telephony universal service and broadband universal service

The 2009 EC Directive on universal service aimed at including more competition and encouraging applications from operators of various sizes and capacities: Universal fixed telephony has thus been split into connection and telephony services and could then potentially be provided by different operators. Connection service is technology neutral (the universal service provider is allowed to use copper, fibre or radio network), whereas universal telephony service obligations only involves providing voice telephony at a fixed location and does not

[41] See Appendix A, Figure A.1 for more indicators on both countries.
[42] Australia coverage has evolved since 2016: 2G has largely been switched off, 3G coverage is now at 99.4% and 4G coverage at 99%.

require voice telephony on the move. In the case of France, a unique operator was appointed for both: Orange – the fixed incumbent operator and the biggest mobile operator in the country.

Every three years, the Minister ('Ministère de l'Economie et des Finances') is in charge of designating the universal service provider, following a call for applications on the technical and pricing conditions of supply of network connection and telephony services. A specification is published in the Official Journal, setting the obligations of the provider, in particular with regards to the scope of its services, the supply conditions and the level of expected quality of service , as set out in Annex III the EU Universal Service Directive[43]. In case of unsuccessful competitive tender, the Minister may appoint a universal service provider ex officio.

Orange was the only operator to apply for the call for applications, by submitting an offer that was deemed admissible[44]. Orange was therefore designated universal service provider at the beginning of 2018 by decree of the Minister, to which was annexed a specification setting out the provider's obligations for the next three years.

As it was said earlier, selection criteria include technical and pricing proposals of the bidders. Regarding quality of services, indicators are followed both at national and regional levels: Quarterly and annually measures must be sent to ARCEP by Orange. Objectives for national calls are to keep unsuccessful call ratio below 0,7% of calls and call set up time below 2,9 seconds. In France, there is no latency requirement in USO.

ARCEP is in charge of monitoring compliance with USO. Orange has to publish Year N indicators on 31 March of Year N+1 (at the latest). Between 2014 and 2016, following a sharp deterioration of some QoS indicators presented by Orange, the NRA conducted an administrative inquiry. An action plan was then launched by Orange to improve performance on these indicators. Since 2015, the operator has once more complied with its obligations.

This administrative inquiry was an opportunity for ARCEP to add new performance indicators and get an improved overview of the quality of the network. The following specifications have been amended in 2015:

- About supply of network connection: The bidder has to commit on the choice of connection technology as well as on the share of each technology envisaged on the duration of designation. It is underlined that supply of network connection has to be wireline as much as possible.
- About supply of telephony services:
  - Two additional QoS indicators have been included to the specifications: These relate to provisioning and repair times for connections.
  - Another specification required that, in case the QoS expectations have not been met, the Universal Service Provider will have to provide the regulator and the Minister with a detailed report of its network's weaknesses.
  - Finally, in order to improve insight on network performance in rural areas, the indicators of supply time for initial connection and supply time for repair will have to be followed up by separating rural areas from others.

In terms of geographic obligations, the geographic scope of universal service in France includes all territory (mainland, Guadeloupe, Guyane, Réunion, Martinique, Mayotte, Saint-Barthélémy, Saint-Martin and Saint-Pierre-et-Miquelon).

[43] For voice telephony services the Directive requires universal service providers to supply to ETSI standards in terms of line supply time, fault repair time, call setup time and unsuccessful call rates.
[44] As far as we know, Orange was the only applicant.

Voice telephony universal service is publicly managed and funded exclusively by the private sector. Every year, ARCEP calculates the net cost of universal service:[45] This is the cost burden that the provider could avoid if it was not subject to the universal service obligation. The provider receives compensation for these net costs.

- The compensation scheme through a Universal Service Fund (USF) has been enabled by the European Commission's Universal Service Directive and provided under article L.35-3 of the French CPCE (Post & Electronic Communications Code). The USF is managed by the Caisse des Dépôts et Consignations.[46]

- All operators with a turnover over 5 million euros must contribute to it at a certain percentage of their turnover (in 2013, the average was 0,13% of turnover). In 2017, ARCEP published the procedures to be used for the determination of universal service costs for 2018: Under the new tariffs, the four operators are liable as follows: Orange to 7.7 million euros, SFR to 2.7 million, Bouygues Telecom to 1.8 million and Iliad 1.5 million. ARCEP assesses the net cost of US every year and makes it public. The amount paid by each of the four operators is pro rata to their turnover. Funding for financial period N is done in two steps:

  - On 15 January and 15 September of the year concerned, the operators pay provisional contributions to the USF (an amount equal to half of their last known definitive contribution).

  - The definitive valuations are subject to a decision of ARCEP that intervenes in April of the year N + 2 (at the latest) for the year n; contributions are then regularized by 20 September of year N + 2.

- Management costs for the USF are, like contributions, distributed between all operators.

5.3 The roll-out of universal broadband

France does not include broadband and very high broadband in its scope of universal services. But in July 2017, the French President set up objectives to accelerate internet connectivity in France: guaranteeing an access to all citizens of a minimum of 8Mbits, cover all territories with very high broadband (over 30Mbits) by 2022 and generalize high quality mobile coverage by 2020. Based on that, several initiatives have been set up. For example, the government provides a financial subsidy up to 150 euros to citizens living in remote areas to buy an antenna, a box or a satellite dish.

The objective of the "France Very High Broadband Plan" ("France Très Haut Débit") is to cover the whole population by giving households, enterprises and administrations access to very high broadband services by 2022, based on complementary public and private initiatives. A 20 billion euros investment over 10 years is shared between local government, the central State and private operators in order to cover both rural and urban areas.

- Rural areas – representing 45% of population – are being covered by Public Initiative Networks ("Réseaux d'Initiatives Publiques") that are owned by local authorities[47] and with services provided by

[45] ARCEP determines the net cost of the universal service and decides whether to finance it (that is, whether it is deemed to be an excessive burden for the service provider). Universal service provision is financed by contributions from other operators with annual turnover of over €100m, in proportion to their turnover.
In 2017, ARCEP consulted on the rules used to determine the net cost of universal service. The cost is determined on a geographic basis across 36 'zones'; ARCEP's model calculates the costs and revenues related to universal service for each zone. The model further distributes the indirect costs and revenues related to universal service across these zones. This allows zones to be divided into 'profitable' and 'unprofitable' areas (where there is a net cost). Total net cost is computed as the sum of the net cost in all unprofitable areas.
ARCEP also considers four types of indirect benefit: the ubiquity of its network, growing demand among universal service users, enhanced market intelligence (from having more subscribers), and enhanced brand image. ARCEP concluded that ubiquity and market intelligence benefits from universal service provision were likely to be minimal. However, it factored in a 'life cycle' effect for universal service users, reflecting growing demand over time among such users.
[46] French public sector financial institution.
[47] Local governments ("Collectivités Territoriales")

Internet providers to individuals and enterprises, through different technologies (FttH, ADSL improvement, satellite, WiMax, 4G). In order to cover these areas, the 13-14 billion euros investment is shared 50-50 between public authorities and commercial players: 6,5 billion is funded by public subsidies (including 3,3 billion from the central State) and the other half is funded by operating revenues from Internet providers.

- Very high broadband in urban areas – 55% of population – is deployed and funded by private operators (6-7 billion euros).

In order to guarantee the proper functioning of the internet in France, ARCEP has switched its evaluation method of internet access QoS by making crowdsourced information[48] easily available to internet users – with a single approach for fixed and mobile services. Appendix B gives details.

5.4 The role of the mobile networks

In France, mobile telephony is not part of universal services, but the provision of service is encouraged in several ways:

- Mobile operators have a 4G coverage obligation commitment with timelines associated, including specific commitment for low-density areas (22500 rural municipalities representing 18% of population and 63% of territory).

- In France, one of the government's actions is to ensure that there is a point of 2G/3G mobile connectivity in each village[49]. Surveys are regularly conducted to identify villages that do not have any basic mobile connection (4000 municipalities in 2015, 1% of the French population). These villages are then covered by operators with funding of the State and territorial authorities[50].

- Also, when public payphones were removed in 2014 from the scope of universal services and from Orange's obligations, this was stated as being a compensation for the important investment to be made on mobile coverage in rural areas.

[48] Stakeholders include QoS measurement service providers, operators, consumer associations, etc.
[49] "Programme Zones Blanches Centres-Bourgs"
[50] GRACO/ARCEP Rapport annuel 2017

Figure 5.2: 4G coverage obligation commitment

Deadlines	Jan.17	Oct.19	Jan.22	Oct.23	Jan.24	Jan.27	Dec.30
Overall metropolitan population		60% (2,6GHz)		75% (2,6GHz)	98% (800MHz)	99,6% (800MHz) 98% (700MHz)	99,6% (700MHz)
Population in each metropolitan department					90% (800MHz)	95% (800MHz) 90% (700MHz)	95% (700MHz)
Population in low-density areas (18% of population, 63% of territory)	40% (800MHz)		90% (800MHz) 50% (700MHz)			97,7% (800MHz) 92% (700MHz)	97,7% (700MHz)
Villages program (4000 municipalities)						100% (700MHz & 800MHz)	
Priority main roads (50.000km)						100% (800MHz)	100% (700MHz)
Regional rail network (overall national coverage)			60% (700MHz)			80% (700MHz)	90% (700MHz)
Regional rail network (in each region)						60% (700MHz)	80% (700MHz)

5.5 Key findings

The Universal Service provider (and fixed incumbent) Orange has been appointed following a competitive tender according to technical and pricing criteria.

Universal telephony services in France only involve fixed telephony services. Broadband and mobile services are excluded from them. ARCEP specifies that broadband and very-high broadband are part of the responsibility of consumer services of private operators and are not part of Universal Service.

Nevertheless, all operators do have obligations (outside the USO) on mobile and broadband connectivity and connectivity of all citizens has been included in the government roadmap.

6 Greece

6.1 Overview

Despite challenging geography Greece has strong coverage of basic fixed-line services, with 99% of Greek households covered. However, NGA deployment is low by EU standards. Similarly, take-up of mobile broadband remains low, in part due to high prices. 4G coverage is also low, although the three mobile operators also have a fixed line footprint.

Figure 6.1: Comparative table of country statistics as at the end of 2016[51]

Metric	Australia[52]	Greece
Demographics and economic indicators		
Population (000)	24,126	11,184
Household density per km^2	1.2	27.9
GDP per capita (PPP $)	46,012	26,779
Telecoms indicators		
Mobile subscribers per hundred population	110	112
Fixed telephone lines per hundred households	89	141
Fixed broadband connections per hundred households	80	98
2G coverage (% pop)	99.3%	99.9%
3G population coverage (% pop)	99.3%	99.4%
LTE/WiMax coverage (% pop)	98.0%	93.0%

6.2 The provision of the voice telephony universal service and broadband universal service

The Greek market of wireline services (PSTN and VoIP) is shared between the former State monopoly OTE (Hellenic Telecommunications Organisation) – which provides all its services under the Cosmote brand (OTE is owned by Deutsche telecom at 40%, the government at 10%; remaining shares being distributed) – and four LLU-based services providers: Forthnet (Nova brand), Wind Hellas, Vodafone Greece and Cyta Hellas.

The Universal Service in Greece covers the provision of basic electronic communications services (fixed telephony, directory enquiries and payphone universal services) to all citizens, "regardless of their geographic location, at affordable prices".

The designation of the Universal Service Provider was done following a competitive tendering process:

[51] See Appendix A, Figure A.1 for more indicators on both countries.
[52] Australia coverage has evolved since 2016: 2G has largely been switched off, 3G coverage is now at 99.4% and 4G coverage at 99%.

- In June 2015, applications for fixed telephony, directory enquiries and payphone universal services were submitted by Cosmote Mobile Telecommunications, Forthnet and OTE (Hellenic Telecommunications Organization).

- EETT announced the list of selected participants in the auction: Cosmote Mobile Telecommunications, Forthnet and OTE (Hellenic Telecommunications Organization) were selected for "access at a fixed location to the public telephone network and access to publicly available telephone services at a fixed location" (Only OTE was selected for directory enquiries and public payphones).

- All of them passed the pre-qualification procedure and participated in the auction. Because Forthnet was the lowest bidder, it won the tender in September 2016 to provide the services as from January 2017.

Both PSTN and VoIP are used for the provisioning of universal service. Forthnet uses also Voice over Satellite in remote areas, to cover 100% of the country territory[53] with fixed telephony local network access and voice call services. Forthnet uses for that the satellite platform "Tooway" of Eutelsat (Ka-band Satellite). Tooway provides individuals and households a permanently available service with speeds up to 22Mbps in reception and 6Mbps in transmission. User's devices include a satellite dish (77cm-diameter) and a modem to plug to a PC or a Mac.

Forthnet is compensated by the State for the cost related to Universal Service by a maximum annual fee of EUR4.93 million. Contract duration can be either three or five years and will be decided by Forthnet.

There is no specific requirement regarding latency in universal voice telephony services in Greece. The QoS indicators are shown below.

Figure 6.2: QoS targets for universal voice telephony service in Greece

PARAMETER	TARGET
Supply time for initial connection	1 week for the 80% of orders. 4 weeks for the 95% of orders. 12 weeks for the 99% of orders.
Fault rate per 100 access line per year	13.5
Fault repair time	70% in 36 hours 85% in 72 hours 95% in 144 hours
Bill correctness complaints	0.2 %
Unsuccessful call ratio	2%

6.3 The roll-out of universal broadband

Broadband retail market is shared between Cosmote (47%), Vodafone Greece (17,4%), Forthnet (15,2%), Wind Hellas (11,8%), Cyta Hellas (8,0%) and other players (0,6%)[54]. OTE has largely contributed to the spread of broadband internet in Greece by deploying ADSL technology to 99% of its network and LLU roll out has accelerated the uptake of broadband subscriptions.

[53] The geographic scope of universal service is the whole Greek territory.
[54] Telegeography, December 2017

Nevertheless, it was confirmed that broadband was not part of the universal service obligations in Greece. There is a state aid program for deploying broadband infrastructure in rural areas (broadband white areas), which cover about 525.000 populations (with a minimum speed of 8 Mbps downstream and 1 Mbps upstream).

Some initiatives are implemented to cover the territory. OTE, Vodafone and Wind announced in 2017 that they were investing a total of EUR250 million on the deployment of NGN infrastructure in order to help meet EU targets: OTE through a copper last mile infrastructure, Vodafone and Wind through FttH. The EU Digital Agenda targets that 50% of the population should have access to services of 100Mbps or above by 2020.

6.4 The role of the mobile networks

Cosmote (48,2%), Vodafone Greece (33,1%) and Wind Hellas (18,7%) also share the Greek mobile market.

Provision of Universal Service in Greece is technology neutral (Fixed, Mobile, and Satellite). For the auction, operators participated with the following technical solutions:

- Cosmote: mobile network.
- Forthnet: fixed and satellite.
- OTE: fixed network.

As Forthnet is the USP, mobile services are not used to meet universal service requirements in Greece. However, according to ministerial decision[55], the Universal Service provider is not obliged to establish a connection if another network – fixed or mobile – is available in the area where the request is made and can serve the customer, provided that the price to the end user for the provision of the telephone services is lower or equal to that of the universal service provider.

6.5 Key findings

In theory, provision of Universal Service in Greece is technology neutral (Fixed, Mobile, and Satellite). This is why operators participated in the Universal Service auction with different technical solutions (Cosmote with mobile network, Forthnet with fixed and satellite, and OTE with fixed network.

Forthnet – which is not the national incumbent – was selected based on its lowest price bid. Universal voice services are thus provided through PSTN, VoIP and satellite.

[55] Ministerial Decision 44871/988/2014: "Definition and specialization of the criteria and the content of the reasonable request within the framework of the universal service according to article 57 of Law 4070/2012" (OG 2128/B/4-8-2014).

7 The Kingdom of Saudi Arabia

7.1 Overview

Data and voice services in the Kingdom of Saudi Arabia (KSA) are delivered predominantly via mobile – fixed broadband penetration is under 50% of households and fixed voice around one-third of households, primarily in urban areas. In both the fixed and mobile sector (but especially fixed) the incumbent operator STC maintains a strong position. Ongoing schemes in the KSA aim to expand both the country's mobile and FTTH network coverage.

The Ministry of Communications and Information Technology of the KSA approved the country's Universal Access and Universal Service Policy in 2006. The Policy[56] defined the terms *universal access* and *universal service* in the context of the KSA:

- Universal access means that citizens can access a defined ICT service through public or community facilities.
- Universal service means that citizens are able to subscribe to a defined ICT service on an individual or household basis.

The Policy set out a vision of achieving universal *access* to voice telephony and internet access (at speeds of at least 0.5 Mbps)[57] to each citizen within three and five years, respectively, and universal *service* within five and seven years respectively.

To achieve this vision, a Universal Service Fund (USF) was established by the regulator, CITC. This was intended to be financed by a 'USF Fee', set at 1% of the net revenues of designated service providers (though this was never implemented – to date, the USF is entirely publicly-funded)[58]. A competitive universal service project selection process was also set up, to select Universal Service Providers to provide services within a designated geographic area.

As of 2018, USF Projects are still ongoing in the KSA.

[56] Accessible here: http://www.citc.gov.sa/en/RulesandSystems/bylaws/Documents/LA%20007_%20%20E_%20%20The%20Universal%20Access%20and%20Universal%20Service%20Policy.pdf (English)
[57] See GSMA, https://www.gsma.com/publicpolicy/wp-content/uploads/2016/09/GSMA2013_Report_SurveyOfUniversalServiceFunds.pdf p218
[58] http://www.citc.gov.sa/en/USF/Pages/FAQ.aspx

Figure 7.1: Comparative table of country statistics as at the end of 2016[59]

Metric	Australia[60]	KSA
Demographics and economic indicators		
Population (000)	24,126	32,276
Household density per km^2	1.2	2.0
GDP per capita (PPP $)	46,012	54,417
Telecoms indicators		
Mobile subscribers per hundred population	110	149
Fixed telephone lines per hundred households	89	77
Fixed broadband connections per hundred households	80	70
2G coverage (% pop)	99.3%	99.4%
3G population coverage (% pop)	99.3%	97.2%
LTE/WiMax coverage (% pop)	98.0%	88.0%

7.2 The provision of the voice telephony universal service and broadband universal service

The USF supports a number of macro-scale 'Programs' aimed at achieving specific targets. Each Program consists of one or more 'Projects': micro-scale implementation activities covering a specific area.

The USF Projects are focused exclusively on non-commercial areas that are not already part of any roll-out obligation. Localities with a population of between 100 and 5000 are targets for Universal *Service*, while those with fewer than 100 are targets for Universal *Access*. Around 20,000 localities in total are to be served via the USF, covering around 4.8m people.[61]

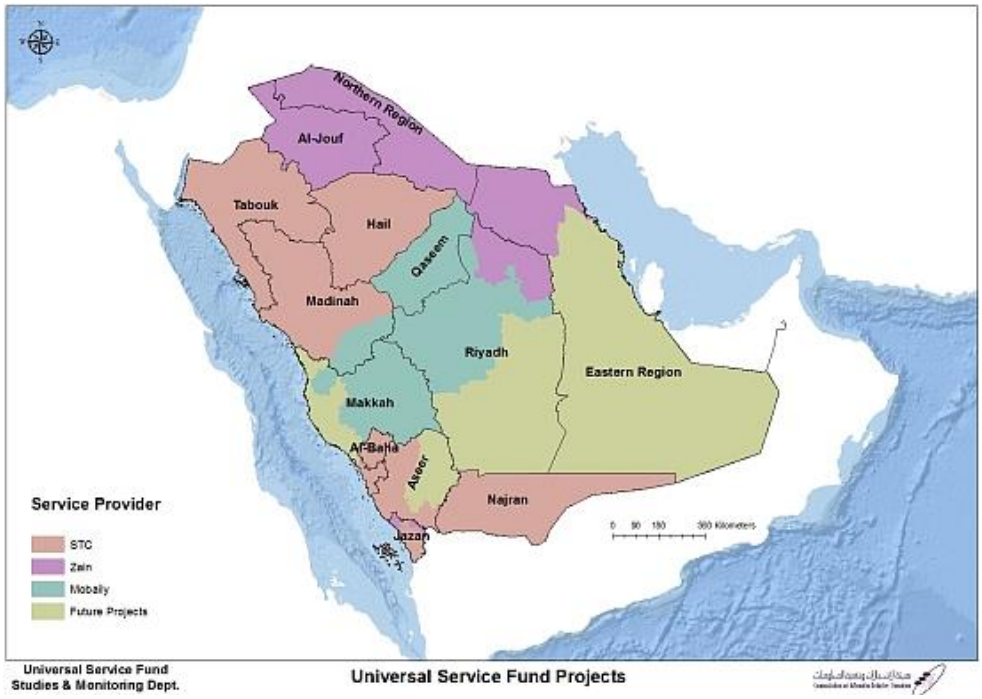
These localities are divided into clusters, which are then combined according to the amount of subsidy required in order to equalise the Universal Service burden. Projects to deliver Universal Service and Universal Access within these clusters are tendered to the operators, with the lowest tenderer winning. Tenders were conducted competitively on a technology-neutral basis. The incumbent operator, STC, has won the majority of these tenders, covering 55% of the universal service population.

For localities with under 100 persons, the operator can supply Universal Access rather than Universal Service (supplying connectivity to a service centre rather than to each individual premises).

Funding is supplied from public funds on a per Project basis, according to the capex and opex of the Project. Operators retain pricing flexibility in the regions in which they are the Universal Service Provider.

[59] See Appendix A, Figure A.1 for more indicators on both countries.
[60] Australia coverage has evolved since 2016: 2G has largely been switched off, 3G coverage is now at 99.4% and 4G coverage at 99%.
[61] http://www.citc.gov.sa/en/USF/Pages/FAQ.aspx

Figure 7.2: Map of USF Projects by Service Provider



The CITC is now about to launch a new round of bidding for an upgraded universal service which delivers at least 10 Mbps per household as well as voice to 70% of the universal service population. The incumbent universal service provider (who has invested in covering the area) has a significant advantage in such bids and CITC expects the incumbent to win the new bids in most cases by upgrading to 4G.

7.3 The roll-out of universal broadband

In parallel with the deployment of Universal Service and Universal Access, the Ministry of Communications and Information Technology is supporting the National Broadband Initiative. The aim of the initiative is to subsidise the roll-out of FTTH to an additional 2.1 million premises which would otherwise not be passed by fibre. This is supported with a 30% one-off subsidy from the Government.

The incumbent operator, STC, and the state electricity company signed agreements with the Government in August 2017. This agreement provided for state financial support of US$720m for deploying high speed broadband.

The Government's National Transformation Plan has a target of 55% FTTH coverage in urban areas by 2020.

7.4 The role of the mobile networks

Universal service and the universal access are currently supplied by the mobile operators over 3G networks. The requirement is for reception by mobile devices rather than via fixed antenna. As there are plans to upgrade these networks in universal service areas, it is likely mobile will remain key to the provision of universal services.

7.5 Key findings

Saudi Arabia's geography and technology-neutral approach to tendering universal service Projects have meant that mobile is the natural answer for delivering universal service. The process of dividing up universal service areas into distinct clusters has meant that there is no single Universal Service Provider, although STC has won the projects to deliver Universal Service to the majority of the eligible population.

For the moment there is no choice for users in the universal service areas. However, the CITC is now considering a requirement for the universal service provider to offer national roaming in the universal service areas it supplies.

8 Portugal

8.1 Overview

The Portuguese broadband market has experienced a high growth in the past few years, based on the development of NGNs and on mergers & acquisitions. It is shared by NOS[62] (37,4%), PT Portugal (31,1%), Vodafone Portugal (16,7%), Nowo (4,3%) and other players (10,5%).

Portugal's mobile market is one of the most saturated of Europe with a penetration of around 150%. It is shared by three operators:

- MEO (formerly TMN brand) is the wireless arm of PT Portugal, is owned by Altice Group and has 40% market share;
- UK-owned Vodafone Portugal has a market share of 31%; and
- NOS, 29% market share, is backed by Angolan billionaire Isabel dos Santos.

Figure 8.1: Comparative table of country statistics as at the end of 2016[63]

Metric	Australia[64]	Portugal
Demographics and economic indicators		
Population (000)	24,126	10,372
Household density per km^2	1.2	39.9
GDP per capita (PPP $)	46,012	30,607
Telecoms indicators		
Mobile subscribers per hundred population	110	112
Fixed telephone lines per hundred households	89	131
Fixed broadband connections per hundred households	80	92
2G coverage (% pop)	99.3%	99.8%
3G population coverage (% pop)	99.3%	99.3%
LTE/WiMax coverage (% pop)	98.0%	98.8%

[62] All data are 2017 Telegeography.
[63] See Appendix A, Figure A.1 for more indicators on both countries.
[64] Australia coverage has evolved since 2016: 2G has largely been switched off, 3G coverage is now at 99.4% and 4G coverage at 99%.

8.2 The provision of the voice telephony universal service and broadband universal service

Universal services in Portugal are qualified in the Electronic Communications Law as "*a set of defined benefits of specified quality available to all end-users, regardless of their geographical location and at an affordable price*". They include:

- Access/connection to the public communications network & telephone services at a fixed location (US Provider: NOS).
- Provision of public pay-telephones (US Provider: MEO).
- Provision of comprehensive telephone directories and directory enquiry services (US Provider: MEO).

The Portuguese US providers work under administrative contracts concluded with the Portuguese State.

In the context of provision of access and connection to the fixed telephone services, obligations include – free of charge – handset amplifying equipment (for people with hearing disabilities), call warning light (visual signal when a call is received), simple bills in Braille and fixed destination lines (automatic establishment of calls to a destination defined by the customer).

Under the law, "the provider designation process must be effective, objective, transparent and non-discriminatory, ensuring from the outset that all companies have an opportunity to be designated. The providers are designated by Resolution of the Council of Ministers, following a tender procedure organized for the purpose; the designation is then formalized in a contract".

The regulator is responsible for ensuring transparency and accountability, for auditing the net costs of universal service, and for charging operators the amount they should contribute to the compensation fund.

In 2014, NOS[65] (NOS Comunicações) was designated for 5 years as the operator in charge of universal service for access and connection to the public communications network and telephone services, following a competitive tender process.

In order to attract the largest number of applicants, three distinct regions (lots) were created: Zone 1 – North; Zone 2 - Middle of Portugal and islands; Zone 3 - South. The bidders were Portugal Telecom, Vodafone, Optimus and Zon TV Cabo Portugal. These two last companies were then merged into NOS. The main selection criterion for the Universal Service provider was pricing. The company or companies to be selected would be those that would be able to ensure the quality and price evolution (as specified in the tender procedures) by requesting a lower financing amount of the net costs associated with the provision of services: NOS was designated as USP because its proposal involved lower net costs, thus reducing the burden of universal service funding.

Universal services are financed by a compensation fund[66], managed by ANACOM – Autoridade Nacional de Comunicacoes, the telecommunication regulatory body – and created in 2012. Contributions come from electronic communications companies, provided they have a market share higher than 1% of the whole sector's eligible turnover. Their maximum contribution is related to their annual turnover and corresponds to 3% of it at the highest. Over a five-year period, financing the universal service provision totals 9.6 million euros: For service provision in 2014 and 2015, NOS has received 3.05 million euros from the US Fund (to which the company itself

[65] NOS is the company formed following the merger of two operators, ZON and Optimus, in 2013. Both operators had been designated as Universal Service Providers for fixed telephony services (ZON in the south and islands, Optimum is the north and central region).
[66] https://www.anacom.pt/render.jsp?contentId=1136652&languageId=1

contributed 0.87 million euros; MEO, Vodafone, Nowo and ONI contributed a total of 2.18 million euros). For service provision between 2016 and 2019, NOS still has 6.55 million euros to receive.

Voice universal services obligation shall allow users to make and receive national and international calls, as well as access emergency services through the national emergency number (defined in the National Numbering Plan). There are no limitations regarding the geographic scope of universal service for voice telephony in Portugal.

This provision can be made either using wired or wireless networks (provided that the respective providers are legally authorized and able to offer networks and services at a fixed location): The services are provided only at end-user's location or residence and can be provided through the USO (NOS) distribution network, through voice over IP technology or using wireless technology, in which case frequencies and mobile technologies are used. There are no specific requirements regarding latency.

ANACOM[67] has recently made the recommendation to the State to terminate the fixed telephone universal service contract, based on the lack of demand (only 2 customers since beginning of the contract between NOS and the State in 2014), considering that the objectives underlying the universal services are met by the market on a competitive basis.

The universal service contracts concluded between the State and the USPs stipulate the amounts to which they are entitled, taking into account the net costs of providing the US. One of these contracts provides only for a fixed component of financing (telephone directories and directory enquiries). The other two contracts (public payphones and telephone service at a fixed location) provide both a fixed component and a variable component.

Under the contract for telephone service at a fixed location, NOS is entitled to be fully compensated until the end of the contract (May 2019) even though the current existence of only 2 subscribers and no demand for service for people with special needs, retired persons and pensioners. This means that NOS has already received from the US compensation fund a total value of over EUR 3m (for which the company contributed EUR 0.87 million and MEO, VODAFONE, NOWO and ONI contributed a total of 2.18 million euros) for the compensation related to 2014 and 2015, and it is still to receive a further EUR 6.5m+, corresponding to the provision of the service in the years 2016 to 2019. This is the reason why ANACOM has recommended to the Government the early termination of the contract and that in the future there is no place for the designation of a new USP.

8.3 The roll-out of universal broadband

Functional access to the Internet with a minimum speed of 56 kbps is a universal service obligation in Portugal. This access has to be available at no additional fixed cost in terms of network access over the monthly subscription charge for connection to the communications network.

Public funding (EU and national public funds) – as well as obligations associated with the acquisition of rights to use frequencies in the 800 MHz band – contributes to the development of high-speed internet in Portuguese rural areas. But broadband is still in a growing phase: Including broadband within the universal service obligation is not a reality yet but it is under constant review. The situation might indeed change upon the approval of the future European electronic communications code.

Broadband funding in rural areas is mainly public (EU funds and national public funds). There are several public initiatives in place, including the "Digital Agenda" that foresees *inter alia* the improvement of conditions of access of the population in rural regions to broadband with a speed of 40 Mbps or higher.

[67] https://www.anacom.pt/render.jsp?contentId=1423190&languageId=1

In addition, it is worth mentioning the implementation of the new generation networks (including in rural areas) that were the subject of contracts between the Portuguese State and several wholesale regional telecom operators. In this case, the availability of broadband is partially supported (70%) by public funding, with the participation of EU funds.

Finally, there was no public funding associated to the ANACOM's decision to impose coverage obligations on operators with rights of use of frequencies in the 800 MHz band, and later on the imposition of obligations of additional coverage as part of the process of renewal of the rights of use of frequencies in the 2.1 GHz band (to be met in 2019).

8.4 The role of the mobile networks

Mobile networks and services are currently outside the universal service regime in Portugal, both in terms of affordability and availability. The US provision of access and telephony services only covers the service provided at a fixed location. However, as a principle of technological neutrality applies to the service provided at a fixed location, the US provider can choose between several network technologies for that purpose, including mobile networks.

8.5 Key findings

As in Greece, the Universal Service provider in Portugal has been selected following a competitive process and is not the incumbent operator. Broadband and mobile services are currently outside the universal service regime in Portugal. Under the principle of technology neutrality universal service provider can choose what network technology it uses to meet its universal service obligation

Based on the lack of demand for universal voice telephony services, the regulator has recommended the dropping of voice telephony from universal service scope. A public consultation was conducted by ANACOM in 2017 on the revision of Universal Service. The results have not yet been published.

9 Sweden

9.1 Overview

The Swedish market has witnessed widespread deployment and take-up of ultrafast broadband services, with municipalities playing a role in deploying FTTH networks (there are over 180 local fibre networks in Sweden). The Swedish mobile sector is similarly well developed, with half of mobile subscriptions being 4G subscriptions and some of the cheapest mobile broadband packages in Europe.

In Sweden, all households have the right to request affordable access to telephony and a functional internet service. In February 2012, functional internet access was defined as a minimum level of 1 Mbps,[68] after the Government noted that the previous USO level – 20 kbps – was not enough to provide basic electronic services (including communicating with the authorities). The Government has just updated the definition of functional internet access to at least 10Mbps and the regulator, PTS, has been commissioned by the Government to procure internet access to fulfil this requirement where a household or place of work is not able to procure a suitable connection under normal market conditions. PTS has never defined an affordable price.

Figure 9.1: Comparative table of country statistics as at the end of 2016[69]

Metric	Australia[70]	Sweden
Demographics and economic indicators		
Population (000)	24,126	9,838
Household density per km^2	1.2	10.3
GDP per capita (PPP $)	46,012	48,905
Telecoms indicators		
Mobile subscribers per hundred population	110	127
Fixed telephone lines per hundred households	89	67
Fixed broadband connections per hundred households	80	79
2G coverage (% pop)	99.3%	100.0%
3G population coverage (% pop)	99.3%	100.0%
LTE/WiMax coverage (% pop)	98.0%	100.0%

[68] The obligation is specified as follows: a user must receive 1 Mbps peak speeds, and the average during any 24-hour period must not fall below 750 kbps. The speed must not fall below 500 kbps in the slowest four hours of any 24-hour period.
[69] See Appendix A, Figure A.1 for more indicators on both countries.
[70] Australia coverage has evolved since 2016: 2G has largely been switched off, 3G coverage is now at 99.4% and 4G coverage at 99%.

9.2 The provision of the voice telephony universal service and broadband universal service

Until 2003 Sweden ran a 'traditional' USO model, in which the incumbent operator was appointed as the universal service provider. This model focused on the supply of voice telephony over the traditional telephone network (PSTN). There was no public funding of this model.

However, growing numbers of customers for alternative technologies (including IP-telephony), and the falling market share of the incumbent, prompted a reassessment of the USO.[71] It was recognised that growing competition made it harder for the incumbent alone to supply non-profitable end users.

The result was a multi-stakeholder model, with no designated universal service provider. Various technologies can be used to provide universal service, including PSTN, mobile, LTE, and FTTH. The provision of service is encouraged in several ways:

- Mobile operators have a coverage commitment in their licence conditions to provide connectivity to remote areas.
- Spectrum and infrastructure sharing agreements, which have allowed quicker deployment of services.[72]
- Spectrum licences can also carry coverage commitments to provide outdoor mobile coverage to handheld devices. For example, for the 700 MHz band, PTS's proposed requirement is for improved coverage of mobile voice and data services (of at least 10 Mbps) in non-commercial areas. While the focus is on outdoor coverage, PTS expects that new mast sites will also lead to "improved indoor coverage in the surrounding area". PTS specifies that "the effects should be measurable and possible to follow up".[73] Similarly, in the 800 MHz band, a selected operator is obliged to provide coverage for residential homes and businesses that are pinpointed by the PTS. The related cost is met by the operator but compensated by a reduction in the amount paid for the 800 MHz spectrum licence.

Where there is no market provision of universal service, the regulator will procure a solution (on a technology-neutral basis). However, this is rare: currently, only 16 extremely remote households are supplied in this way. These are supplied via the 450 MHz band mobile, satellite and repeater technology.[74] PTS is granted funding by the Government to supply these households.

Under the 'technology shift' program, Telia (previously called TeliaSonera, the former state incumbent) dismantled parts of the fixed telephone network, replacing it with fibre or the mobile network.[75] From the start of the program in 2009, 30,000 subscribers have been shifted from the fixed network to the mobile network. These include both end-users and operators who rent capacity in Telia's copper network. The technology shift is monitored by the PTS.

End-users affected by the technology shift must retain access to at least USO-capable services (from any provider), but Telia are not obliged to offer an equivalent service – or even any service at all. A 'Telecom Guide' provided by Telia advised affected users of their connectivity options (including from rivals). A similar but larger project, affecting telephony and ADSL subscribers, started in 2016.

[71] Sara Andersson (2011), http://www.europarl.europa.eu/document/activities/cont/201104/20110412ATT17542/20110412ATT17542EN.pdf
[72] European Commission (2014), Information Society Updates – Sweden http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=6469
[73] PTS (2018), *"Consultation regarding assignment of licences in the 700 MHz band"* https://www.pts.se/contentassets/.../consultation-700mhz-feb2018.pdf
[74] *Id.*
[75] See https://www.teliacompany.com/en/news/news-articles/2018/the-fall-of-copper-watch-telia-shift-technologies/

Two satellites provide nationwide services in Sweden. The PTS conducted a study to examine whether satellite services could be considered equivalent to fixed telephony and broadband, in terms of functionality, quality, ease of use and cost. The study concluded that broadband and IP telephony over satellite worked well enough to fulfil the USO. The PTS who administer the USO, places no quality of service (QoS) requirements on the satellite services. Users of satellite purchase a broadband subscription and then use an IP-telephony application for voice communication.

9.3 The roll-out of universal broadband

In 2009 Sweden introduced a Broadband Strategy, stating its aim that 90% of households should have access to 100 Mbps broadband by 2020. This was to be achieved by a mix of private and public investment. As of 2015, 67% of premises could access 100 Mbps broadband, and 87% could access 30 Mbps broadband.

Tax relief was introduced for fast broadband. Government grants were made available in prioritised areas – particularly those areas with limited expectations of commercial deployment. However, the emphasis was placed on local governments and municipalities to promote broadband deployment. Municipal projects are required to provide access to their broadband infrastructure on non-discriminatory terms. [76] In 2015, operators' investments in fixed broadband infrastructure reached 9bn SEK; the municipal cities' investments reached 2.3bn SEK.[77]

In 2017 the Swedish Government published an updated Broadband Strategy.[78] This updated the targets introduced in 2009. By 2025 the Government intends that:

- 98% of households will have access to 1 Gbps;
- 1.9% of households will have access to 100 Mbps; and
- the remaining 0.1% will have access to 30 Mbps.

This is again expected to be delivered through a mixture of private, municipal and Government investment. Cooperation between these different stakeholders is facilitated through Bredbandsforum, in order to secure effective expansion of the broadband infrastructure. The forum also has the mission of organising encounters between operators, authorities and other organizations in order to collectively identify obstacles to the provision of broadband access across Sweden.

The Government has just updated the definition of functional internet access to at least 10Mbps[79] and the regulator, PTS, has been commissioned by the Government to procure internet access to fulfil this requirement where a household or place of work is not able to procure a suitable connection under normal market conditions.

A variety of different technologies are expected to be used to provide service in different localities, as illustrated in Figure 9.2. This includes "wireless broadband technologies including aerial fibre based on radio connections from one point to another".

[76] http://www.konkurrensverket.se/globalassets/om-oss/financing-of-the-the-roll-out-of-broadband-networks.pdf
[77] http://www.government.se/496173/contentassets/afe9f1cfeaac4e39abcdd3b82d9bee5d/sweden-completely-connected-by-2025-eng.pdf
[78] *Id.*
[79] Functional internet access of at least 10Mbps to all permanent households and places of work has been specified in an updated article 29 of Swedish Government regulation 2003:396 and 2011:1587 which came into force on1 March 2018.

Figure 9.2: Mix of technologies expected to be used for different end-user locations

9.4 The role of the mobile networks

The use of mobile networks is critical to the delivery of the voice and broadband USO in the more rural parts of Sweden. In some areas with mobile coverage, Telia has even decommissioned part of the fixed network. When decommissioning the fixed network Telia typically offers (but is not required to offer) a voice, and more recently also mobile based broadband service at a fixed location.

Coverage commitments in operator and spectrum licences have extended the coverage of mobile networks. A collaborative outlook and a forum for providers allow operators to work with municipal networks to backhaul mobile infrastructure.

9.5 Key findings

Sweden's technologically-neutral approach, its use of mobile to deliver both voice and broadband at a fixed location, and its acceptance of satellite as a technology capable of providing universal services, has left it with only a tiny residual unserved population of end-users. This population is small enough that the PTS has procured individual solutions itself, bypassing the need for a designated universal service provider or universal service fund.

Sweden's collaborative approach between operators, local authorities and national Government has helped to drive a rapid expansion of broadband infrastructure since 2009.[80] This is also likely to have contributed to reducing the number of end-users who require a universal service product.

[80] http://www.government.se/496173/contentassets/afe9f1cfeaac4e39abcdd3b82d9bee5d/sweden-completely-connected-by-2025-eng.pdf

10 United Kingdom

10.1 Overview

There are four main providers of fixed broadband in the UK – BT, Virgin Media, Sky and TalkTalk – who supply broadband through a variety of technologies. The former incumbent, BT, maintains an extensive fixed network and supplies wholesale inputs to other operators, notably Sky and TalkTalk. In the mobile sector there are four operators which, taken together, provide 4G coverage to around 98% of UK premises.

In the UK there is a requirement for BT (and Kingston Communications in Kingston-upon-Hull)[81] as the universal service provider to meet the universal service specified in the 2009 Universal Services Directive.[82] This requires:

- all reasonable requests for connection from a fixed location to the fixed telephone network to be met;
- connections to support *functional Internet access* as well as voice telephony; and
- provision of a range of other services which includes payphones, emergency services access, access by disabled people and directory services. These are not considered in our case study.

The broadband speed requirements to meet the obligation to provide *functional Internet access* is not clearly defined. However, Guidelines issues in 2003 suggested that consumers should expect speeds of at least 28.8 Kbps.[83] Neither the 2002 nor the 2009 versions of the Directive mention latency in defining quality of service.

In 2015, the Government set out its aim for access speeds of at least 2 Mbps for everyone in the UK.[84] This will be superseded by a forthcoming broadband USO which will give everyone in the UK the right to request a 10 Mbps connection.

In parallel and independently of this universal service obligation on BT, the UK government has subsidised the rollout of superfast broadband[85] to high cost areas in the UK via projects run by Broadband Delivery UK (BDUK).[86]

[81] https://www.ofcom.org.uk/phones-telecoms-and-internet/information-for-industry/telecoms-competition-regulation/general-authorisation-regime/universal-service-obligation
[82] Directive 2009/136/EC of the European Parliament and of the Council, 25 November 2009
[83] https://www.ofcom.org.uk/__data/assets/pdf_file/0021/34266/statement.pdf
[84] https://www.gov.uk/government/publications/2010-to-2015-government-policy-broadband-investment/2010-to-2015-government-policy-broadband-investment
[85] Over 24 Mbps download speeds
[86] https://www.gov.uk/government/publications/2010-to-2015-government-policy-broadband-investment/2010-to-2015-government-policy-broadband-investment

Figure 10.1: Comparative table of country statistics as at the end of 2016[87]

Metric	Australia[88]	UK
Demographics and economic indicators		
Population (000)	24,126	65,789
Household density per km^2	1.2	109.6
GDP per capita (PPP $)	46,012	42,609
Telecoms indicators		
Mobile subscribers per hundred population	110	120
Fixed telephone lines per hundred households	89	125
Fixed broadband connections per hundred households	80	94
2G coverage (% pop)	99.3%	99.6%
3G population coverage (% pop)	99.3%	99.6%
LTE/WiMax coverage (% pop)	98.0%	98.5%

10.2 The provision of the voice telephony universal service and broadband universal service

BT was appointed as the universal service provider when the Universal Services Directive first came into force in 2003. BT is required to fund this obligation itself. The net cost of doing so is not judged to be an unfair burden. As part of its universal service obligation BT offers special social tariffs for fixed line connections to those on low incomes. These packages are little used, with prepaid mobile being an effective substitute.

The voice telephony universal service is provided via the wireline copper access network. BT is required to provide connection only if the cost of doing so is less than £3,400. [89] End users who want a connection which costs more than this must fund the excess cost themselves.

There are no statistics on how much this cost cap suppresses demand for fixed voice telephony in rural areas. But we believe it might be a significant proportion of the last 1 to 2% of premises where the costs of provision are highest.

The Universal Service Directive also requires any connections supplied to be capable of supporting functional internet access. A speed requirement was never defined, nor were any other quality metrics such as latency.

The UK Government is in the process of imposing a broadband USO with a minimum speed requirement of 10 Mbps.[90] It is aiming for this USO to be in place by 2020 at the latest. This broadband USO will have the following characteristics:

[8787] See Appendix A, Figure A.1 for more indicators on both countries.
[88] Australia coverage has evolved since 2016: 2G has largely been switched off, 3G coverage is now at 99.4% and 4G coverage at 99%.
[89] Originally calculated as 100 hours of work at £34 per hour
[90] https://www.gov.uk/government/news/high-speed-broadband-to-become-a-legal-right

- End users at premises not covered by the initial scheme for rollout of superfast broadband are entitled to a low latency broadband connection with a minimum download speed of 10 Mbps and a minimum data cap of 100GB per month.

- They should pay the same price as for corresponding broadband services in commercial areas.

- The universal service provider must supply this service unless the cost is greater than a cost threshold. The level of the cost threshold is under debate. If, as seems likely, it is set at £3400 – the same cap as for the voice USO – then this might exclude around 100,000 premises or 0.3% of the 29 million premises in the UK.[91]

- The last 0.3% of premises might use a commercial satellite broadband service instead. There is now discussion about the Government continuing to subsidise the initial costs of such a service. (The government ran a scheme whereby it provided a £350 voucher towards the cost of an end-user installing and using satellite broadband in eligible areas. But this scheme closed at the end of 2017).

- The net cost of meeting the broadband USO will come from an industry fund. The mechanism for appointing universal service providers has not yet been defined. But, on cost efficiency grounds, many expect BT to be appointed as the single universal service provider.

BT offered to supply broadband connectivity of at least 10 Mbps for all except the last 1% (300,000) of premises without charge. However, the Government rejected this offer in favour of a USO.

We are not aware of any discussion about using the broadband USO to meet the voice telephony USO. But, given the way it is defined, it is likely that the broadband USO will be delivered primarily over the copper access network.[92] This would mean that the geographic reach of the broadband USO would not extend further than that of the voice telephony USO.

10.3 The roll-out of universal broadband

In 2010 BT announced that it would roll out superfast broadband to just under 70% of the UK using fibre to the cabinet technologies. The UK government then developed a scheme to subsidise further rollout on an area by area basis. In theory there was competitive bidding to decide who would roll out in each area. But in practice BT was the sole universal broadband provider under this scheme.

The scheme was in three phases:

- Phase 1 expanded superfast broadband (SFBB) availability from 70% to 90% of the population for a public subsidy of £1.2 billion. BT completed this phase using VDSL in early 2016;

- Phase 2 was designed to expand SFBB from 90% to 95% of the population. Nearing completion it is expected that coverage will reach 98% when finished. Phase 2 involves a public subsidy of £0.5 billion; and

- Phase 3 was designed to cover the remaining 2%. However, the intent now is to replace Phase 3 with a broadband USO. The Government is aiming for the USO to be in place by 2020 at the latest

[91] *The impacts of a broadband USO in the UK*, Plum report to the Broadband Stakeholder Group, May 2017
[92] Supplemented with some fibre to the home in certain circumstances

10.4 The role of the mobile networks

The UK reports a population coverage of 99.6% for both 2G and 3G services.[93] Mobile is not currently used to meet the voice telephony USO but given the reach and affordability of mobile services in the UK, it is likely that mobile substitutes for fixed voice in many cases, particularly for lower-income households.

10.5 Key findings

There has so far been no effective competitive bidding to appoint a universal service provider in the UK. In the case of voice telephony BT was appointed as the universal service provider; and in the case of universal broadband BT was the only effective bidder for government subsidy.

There is as yet no obvious attempt to link up the parallel activities – universal service for voice telephony at a fixed location; universal broadband; and extending rural mobile network coverage – to improve the geographic coverage of telecommunications services. These three initiatives have proceeded independently and users in remote, high cost, areas must currently decide for themselves what to do to get the best telecommunications services.

The funding of the universal service initiatives varies considerably:

- BT is required to fund the voice telephony USO itself;
- the Government has subsidised universal broadband and extensions to mobile coverage; and
- the broadband USO will be funded by the industry.

Given the pressure on government revenues from other sources – such as health, social care and education – there are incentives for the Government to leave the voice telephony USO unchanged.

[93] ITU Yearbook of Statistics 2017. This is the coverage provided to end users by one or more networks

