

1 Executive Summary and Introduction

1.1 A globally shared goal: Ubiquitous, seamless, high-capacity connectivity in the next generation

Fostering the development of a ubiquitously networked society, connected over high-capacity networks, is a widely shared goal among both developed and developing countries. High capacity networks are seen as strategic infrastructure, intended to contribute to high and sustainable economic growth and to core aspects of human development. In the pursuit of this goal, various countries have, over the past decade and a half, deployed different strategies, and enjoyed different results. At the Commission's request, this study reviews the current plans and practices pursued by other countries in the transition to the next generation of connectivity, as well as their past experience. By observing the experiences of a range of market-oriented democracies that pursued a similar goal over a similar time period, we hope to learn from the successes and failures of others about what practices and policies best promote that goal. By reviewing current plans or policy efforts, we hope to learn what others see as challenges in the next generation transition, and to learn about the range of possible solutions to these challenges.

Among the countries we surveyed, two broad definitions of “broadband” have emerged for the purpose of planning the transition to next-generation networks. The first emphasizes the deployment of substantially higher capacity networks. This sometimes translates into a strong emphasis on bringing fiber networks ever closer to the home. High capacity is mostly defined in terms of download speeds, although some approaches also try to identify a basket of applications whose supportability defines the quality of the desired next generation infrastructure. The second emphasis is on ubiquitous, seamless connectivity. Exemplified most clearly by the planning documents of Japan, which has widely deployed fixed and mobile networks half a generation ahead of networks in the United States and Europe, this approach emphasizes user experience, rather than pure capacity measures. Just as the first generation transition from dial-up to broadband included both the experience of much higher speeds, and the experience of “always on,” so too next generation connectivity will be typified not only by very high speeds, but also by the experience that connectivity is “just there”: connecting anyone, anywhere, with everyone and everything, without having to think about it.

All countries we surveyed include in their approaches, strategies, or plans, a distinct target of reaching their entire population. Many of the countries we observed explicitly embrace a dual-track approach in the near future: achieving access for the entire population to first-generation broadband levels of service, and achieving access to next generation capabilities for large portions of their population, but not necessarily everyone, in the near to medium term.

1.2 A multidimensional approach to benchmarking helps us separate whose experience is exemplary, and whose is cautionary, along several dimensions of broadband availability and quality

Our first task is to understand how to distinguish countries whose broadband outcomes are more successful from those whose outcomes are less desirable, so that we can tell which countries' experiences are exemplary, and which provide more of a cautionary tale. We reviewed a range of current efforts at benchmarking the broadband performance of different countries, and conducted our own independent studies and evaluations to complement and calibrate existing efforts. As a result of this process we have been able to produce a set of benchmarks on the three attributes of particular interest—penetration, capacity, and price—that we believe offers more fine-grained insights, and with greater

confidence, than do the benchmarks that have commonly been used in American public debates over broadband performance. These benchmarks focus on the quantity, quality, and price of Internet connectivity in the United States, by looking at: (a) how many people have fixed, mobile, and nomadic broadband, (b) what is it that they “have” technically, and (c) at what prices. For each measure we use more than one metric and more than one independent source or approach to measurement. For speeds we use actual measurements from two different companies, measuring in different locations in the network. For prices, we use three independent datasets, with close to 1000 observations. The results from these independent sources, using independent measurement approaches, bolster the level of confidence in our findings.

1.2.1 The United States is a middle-of-the-pack performer on most first generation broadband measures, but a weak performer on prices for high and next-generation speeds

Our findings confirm the widespread perception that the United States is a middle-of-the-pack performer. On fixed broadband penetration the U.S. is in the third quintile in the OECD; on mobile broadband penetration, in the fourth quintile. In capacity the U.S. does better, mostly occupying the second quintile by measures of both advertised and actual speeds. In price the picture is mixed, showing good performance on prices for the very low speed offerings, and very high prices, relatively, as speeds increase. The U.S. does reasonably well for the lowest prices available for the slowest speeds, below 1.5Mbps. Prices rise significantly as the offerings become those that are more “current generation”: both in the 2-10Mbps category and the 10-32 Mbps high-speed category—where the US is 19th of 30 or 18th of the 28 that have high speed access, respectively. In prices for next generation speeds, the U.S. has the highest average prices from top-four providers in the OECD for speeds above 35Mbps, and is ranked 19th of 19 in that category. On those few measures where we have reasonably relevant historical data, it appears that the United States opened the first decade of the 21st centuries in the top quintile in penetration and prices, and has been surpassed by other countries over the course of the decade.

Table 1.1. United States rank among OECD countries, Berkman studies on dimensions of penetration, speed (advertised and actual), and price (by tier of service defined by speed).

Penetration Metrics	Rank amongst OECD 30 countries	Speed metrics	Rank amongst OECD 30 countries	Price metrics	Rank amongst OECD 30 countries
Penetration per 100, OECD	15	Maximum advertised speed, OECD	9	Price for low speeds, combined	9
Household penetration, OECD	15	Average advertised speed, OECD	19	Price for med speeds, combined	19
3G penetration, Telegeography	19	Average speed, Akamai	11	Price for high speeds, combined	18
Wi-Fi hotspots per 100000, Jiwire	9	Median download, Speedtest.net	11	Price for next generation speeds, combined	19
		Median upload, Speedtest.net	5		
		Median latency, Speedtest.net	17		
		90% Download, Speedtest.net	11		
		90% Upload, Speedtest.net	7		

Note: Details in Part 3
Source: OECD, Telegeography, Jiwire, Akamai, Speedtest.net, Point Topic, Berkman Center analysis



1.2.2 Our approach allows us to separate the experiences of other countries into positive and negative along various dimensions of interest

Quite apart from judging the relative performance of the United States, our benchmarking exercise allows us to diagnose which countries are potential sources of positive lessons, and which countries are potential sources of negative lessons. Here, our multidimensional benchmarking approach offers substantial new insights. Canada, for example, is often thought of as a very high performer, based on the most commonly used benchmark of penetration per 100 inhabitants. Because our analysis includes important measures on which Canada has had weaker outcomes—prices, speeds, and 3G mobile broadband penetration—in our analysis it shows up as quite a weak performer, overall. Most other countries do not move quite as much from what that most common benchmarking measure describes, but countries like Switzerland and Norway nonetheless are not as strong performers as they are usually perceived to be, while France exhibits much better performance than usually thought because of its high speeds and low prices. The Netherlands has had good experiences with fixed broadband, but not with mobile, while Italy had exactly the inverse experience. The changes in our interpretation of the experience of other countries are particularly important when our goal is to learn from that experience what practices and policies may be helpful, and what practices may be less helpful, for which outcomes.

1.3 Policies and practices

1.3.1 Transposing the experience of open access regulation from the first broadband transition to next generation connectivity occupies a central role in other nations' plans

Our most surprising and significant finding is that “open access” policies—unbundling, bitstream access, collocation requirements, wholesaling, and/or functional separation—are almost universally understood as having played a core role in the first generation transition to broadband in most of the high performing countries; that they now play a core role in planning for the next generation transition; and that the positive impact of such policies is strongly supported by the evidence of the first generation broadband transition.

The importance of these policies in other countries is particularly surprising in the context of U.S. policy debates throughout most of this decade. While Congress adopted various open access provisions in the almost unanimously-approved Telecommunications Act of 1996, the FCC decided to abandon this mode of regulation for broadband in a series of decisions beginning in 2001 and 2002. Open access has been largely treated as a closed issue in U.S. policy debates ever since. In Part 4 we offer an extensive survey of the literature on open access in the past decade. We find that the econometrics literature is basically divided on whether open access works or not, is surprisingly sparse and weak overall, and is heavily influenced by industry-sponsored work. We explain the severe limitations of many of the econometric studies, whether sponsored by interested parties or not. The existing qualitative work, which is capable of offering more nuanced analysis, tends more clearly to support the beneficial effects of open access, and is less influenced by industry-sponsored work.

In this study, we follow the qualitative work of others by offering new, up-to-date case studies of half of the OECD countries. The evidence suggests that transposing the experience of open access policy from the first generation transition to the next generation is playing a central role in current planning exercises throughout the highest performing countries. In Japan and South Korea, the two countries that are half a generation ahead of the next best performers, this has taken the form of opening up not only the fiber

infrastructure (Japan) but also requiring mobile broadband access providers to open up their networks to competitors. Moreover, countries that long resisted the implementation of open access policies, Switzerland and New Zealand, changed course and shifted to open access policies in 2006.

Transposing the experience of open access in the first generation to the next generation is taking a wide range of alternative forms. The shared core understanding is that the transition to next generation infrastructures re-emphasizes the high upfront costs involved in, or natural monopoly, characteristics of, telecommunications networks, and requires some form of shared infrastructure if competition is to be maintained in the teeth of such economies of scale. At one end of the spectrum is Australia, which is approaching this problem with a plan for a nationally funded fiber network, which will be privatized after completion to a fully open access carrier. The Swedish model, which involves extensive government and municipal funding together with functional separation, marks a large role for government investment that still leaves substantial room for private investment. In the middle are solutions built on the functional separation model introduced in the United Kingdom, and adopted since by Sweden, New Zealand, Australia, and Italy, that requires the carriage portions of the network to be functionally separated from the service provision. The French model involves lighter regulation, defining only narrow portions of the network—in particular ducts and in-building wiring—as open access elements for fiber networks. Finally, there are new emerging models of voluntary or quasi-voluntary shared infrastructure investment, in the Netherlands and Switzerland, whereby the carriers are adopting open access next generation networks as a business proposition, to share and spread the costs and risks of next generation deployments. We describe these approaches in detail in Part 4.

1.3.2 Open access policies in other countries have sought to increase levels of competition by lowering entry barriers; they aim to use regulation of telecommunications inputs to improve the efficiency of competition in the consumer market in broadband

Open access policies seek to make it easier for new competitors to enter and compete in broadband markets by requiring existing carriers to lease access to their networks to their competitors, mostly at regulated rates. The idea is that the cost of replicating the underlying physical plant: digging trenches, laying ducts, pulling copper/cable/fiber to each and every home is enormous; it therefore deters competitors from entering the market in broadband services. By requiring that capacity to be shared, through leasing, with competitors, open access rules are intended to encourage entry by those competitors, who can then focus their own investments and innovation on electronics and services that use that basic infrastructure. The theory underlying open access is that the more competitive consumer broadband markets that emerge from this more competitive environment will deliver higher capacity, at lower prices, to more of the population. The competing theory, that underlies the FCC's decision early in this decade not to impose open access for broadband infrastructure, is that forcing incumbents to lease their network to competitors will undermine that industry's incentives to invest in higher capacity networks to begin with, and without that investment, the desired outcomes will not materialize. We provide a more complete overview of these theories and others, as well as the evidence available to support them, in Part 4.

1.3.3 The emphasis other countries place on open access policies appears to be warranted by the evidence

Because the near-universal adoption of open access is such a surprising result, because this kind of regulation goes to the very structure of the market in broadband and the very nature of competition in next generation connectivity markets, and because the policies adopted by other countries are so at odds with American policies during this decade, we dedicate the bulk of our discussion of policies in other

countries to assessing the international experience on open access regulation. Our approach is primarily qualitative. We undertake detailed country-by-country and company-level analyses of the effects of open access and the political economy of regulation on broadband performance. We find that in countries where an engaged regulator enforced open access obligations, competitors that entered using these open access facilities provided an important catalyst for the development of robust competition which, in most cases, contributed to strong broadband performance across a range of metrics. Today these competitors continue to play, directly or through successor companies, a central role in the competitiveness of the markets they inhabit. Incumbents almost always resist this regulation, and the degree to which a regulator is professional, engaged, and effective appears to play a role in the extent to which open access is successfully implemented with positive effects. In some places where incumbent recalcitrance has prevented effective implementation of open access, regulators have implemented functional separation to eliminate the incentives of the incumbent to discriminate among consumer broadband market providers in access to basic infrastructure. We supplement these case studies with a study of pricing at the company level of 78 companies that offer high speed access. Our pricing study (Figure 4.4) shows that prices and speeds at the highest tiers of service follow a clear pattern. The highest prices for the lowest speeds are mostly offered by firms in the United States and Canada, all of which inhabit markets structured around “inter-modal” competition—that is, competition between one incumbent owning a telephone system, and one incumbent owning a cable system,¹ where the price of entry into the market is the ability to build your own infrastructure. The lowest prices and highest speeds are almost all offered by firms in markets where, in addition to an incumbent telephone company and a cable company, there are also competitors who entered the market, and built their presence, through use of open access facilities. Companies that occupy the mid-range along these two dimensions mostly operate either in countries with middling levels of enforcement of open access policies, or in countries that only effectively implemented open access more recently.

1.3.4 Wireless policies

The next generation broadband user experience is built upon not only the deployment of high capacity networks, but also the creation of ubiquitous seamless connectivity. A central part of this new user experience involves the integration of fixed, mobile, and nomadic access. (By mobile, we mean networks evolved from cellular telephones to offer mobile broadband, primarily 3G networks; by nomadic, we refer to versions and extensions of Wi-Fi hotspots.) Approaching that goal has in most countries been associated with embracing fixed-mobile convergence. In many countries this has entailed accepting vertical integration of fixed with mobile network operators. Importantly, those countries that permit, or even encourage such vertical integration, couple it with open access policies that seek to preserve competition in, and in Japan’s case with net neutrality or non-discrimination rules for, these integrated networks. The countries we reviewed are actively identifying or allocating more spectrum for 4G, or very high speed mobile services, and many are struggling with how to transition existing uses—both earlier generation cellular, and television spectrum—to these future uses.

We review the wireless experience of several countries, both high performers and low, both those that do well in fixed and mobile, and those that do poorly in one but well in the other. We find that the effects of basic policy choices in wireless are difficult to tease apart. We find good performers and poor who have used auctions and beauty contests (that is, the awarding of licenses through a regulatory selection process); we find good performers and poor that started out early with four or five identical 3G licenses, and good performers who started out with what should have led to a weaker market, with only two or

¹ These North American companies are joined by most of the Norwegian highest-speed offerings, including Norway’s incumbent telephone and cable company, as well as one power company. The sole lower-priced Norwegian next-generation offering is from an access-based entrant.

three licenses. We find high performers who imposed strict build-out requirements, and others who did not. Nomadic access has developed with little support from policy: it is increasingly integrated into innovative service models. It is offered by fixed broadband providers who seek to make their networks more flexible, by mobile broadband providers who seek to increase the utility of their networks to their subscribers or reduce load on their 3G infrastructure by handing some traffic over to their nomadic access networks, or through public efforts to create connected public spaces. A major consideration in future planning will be identifying regulatory policies and practices that allow these kinds of integrations that promote seamless, ubiquitous access, without undermining competition.

1.4 Investments in infrastructure and demand side programs

1.4.1 Stimulus and recovery funds are spent in many countries

Like the United States, several countries plan to use stimulus and recovery funds to support rollout of high capacity networks, either to upgrade to fiber for everyone, or to bring underserved areas up to speed. Here we survey the investments of other countries both in response to the economic crisis and in response to the perceived challenges and opportunities of the next generation transition. We found that the current U.S. investment of \$7.2 billion appropriated in the American Recovery and Reinvestment Act, adjusted per capita, is commensurate with, and mostly higher than, investment made in other countries. The exception to this statement is the announced, but not yet fully-funded, very high levels of planned government investments in Australia and New Zealand.

1.4.2 Large, long term investments have played a role in some of the highest performing countries

Several countries have invested over the long term as a strategic choice rather than as a stimulus measure. Sweden's investments are the most transparent in this vein. While the relative share of direct government investment is harder to gauge outside of Sweden, it does appear that the leaders in fiber deployment—South Korea, Japan, and Sweden—are also the leading examples of large, long term public capital investments through expenditures, tax breaks, and low cost loans that helped deployment in those countries. These countries have spent substantially more, in public spending on a per capita basis, than the U.S. has appropriated for stimulus funding. On the other hand, there are models of high performing countries, like France, that invested almost nothing directly, and instead relied almost exclusively on private investment fostered by a competitive environment.

1.4.3 In Europe, substantial effort has been devoted to delimiting when government investment, both national and municipal, is justified and will not risk crowding out private investment

Because public investment risks crowding out market investment, we review current decisions by the European Union on the proper guidelines for when and how public investment is appropriate. In the context of considering municipal investments, like Amsterdam's CityNet, and country-level investments, the European Commission has studied both specific cases and the general policy question under an explicit mandate to limit state interventions that could undermine the development of a common market in goods and services. Here we review that experience, and the new European guidelines, issued September 17th, 2009. These guidelines are a formal decision of the European Commission on two kinds of state and municipal investments. The first is aimed to achieve universal access to first generation broadband technologies. This decision refers to similar problems, and takes a broadly similar approach to, funding for access to unserved and underserved areas as taken under the stimulus funding in the U.S. The second is intended to speed deployment of next generation broadband technologies, so as

to harvest the anticipated social and economic benefits of the next generation transition. On this subject, the European ruling holds that government funding can be appropriate even where there are two present facilities-based incumbents, offering triple-play services, including 24Mbps broadband service, as long as there are no discrete plans for deployment of next generation connectivity, with truly high capacity, within three years, by both incumbents. Moreover, the European guidelines permit government investment where it is shown to be on terms equivalent to what a market investor could have undertaken. Public investments in next generation networks, permissible under these conditions, should be oriented towards providing “passive, neutral, and open access infrastructure.”

1.4.4 Several countries engaged in a range of investments to support broadband demand, including extensive skills training, both in schools and for adults

Several countries we observed invested on the demand side of broadband, not only in supply side policies. Here we survey the experience of these countries, and identify specifically the prevalence of national and local skills training programs. We see adult training, workplace training, and a heavy emphasis in schools, including both teacher training and curriculum development programs. We also see on occasion major programs to subsidize both computers and connections for low income users.

1.5 Overview of this document

The remainder of this document is organized as follows:

- Part 2 outlines current thoughts on “what is broadband?”—that is, how the target of the policy should be defined, and how the definition may reflect on policy emphases. It briefly notes current reasons given in other countries for emphasizing next generation connectivity as a policy goal.
- Part 3 describes our independent assessment of current benchmarking and measurement sources, and describes the results of our independent analysis and testing of benchmarks.
- Part 4 describes our findings on competition and open access policy.
- Part 5 offers an overview of practices and policies concerned with mobile and nomadic access.
- Part 6 discusses government investment practices, on both the supply and demand sides of broadband and next generation deployment.

This document is accompanied by a series of select country overviews, in which we offer country-specific overviews of performance and policies.