

## **Preface**

Following Chairman Genachowski's commitment to evidence-based policy, the Federal Communications Commission requested the Berkman Center for Internet and Society at Harvard University to review international experiences with broadband and plans for next generation connectivity. The study was commissioned on July 14<sup>th</sup>, 2009. The Berkman Center did not receive funding from the FCC, but sought and received funding for this project from the Ford Foundation and the John D. and Catherine T. MacArthur Foundation.

We submitted a draft report on October 13, 2009. The draft included a review of current international benchmarking exercises, as well as new benchmarking measurements done by the Berkman Center using market analysis and actual measurement sources; an extensive qualitative review of county-by-country case studies; a review of current next generation plans, transposing those experiences, currently under review or in implementation in the observed countries; and reviews of wireless policies and government expenditures aimed to improve next generation connectivity.

Our most prominent initial findings, confirmed and extended in this final draft, were that U.S. broadband performance in the past decade has declined relative to other countries and is no better than middling. Our study expanded the well known observation with regard to penetration per 100 inhabitants, and examined and found the same to be true of penetration per household; subscriptions for mobile broadband; availability of nomadic access; as well as advertised speeds and actually measured speeds; and pricing at most tiers of service. Our study further identified the great extent to which open access policies played a role in establishing competitive broadband markets during the first-generation broadband transition in Europe and Japan, and the large degree to which contemporary transpositions of that experience were being integrated into current plans to preserve and assure competitive markets during the next generation transition.

The draft was posted by the FCC on October 14, 2009 for a comment period ending November 16, 2009. The draft drew extensive commentary, both positive and negative. Many comments were constructive and made very useful suggestions and critiques. These suggestions have been helpful in guiding additional research since the release of the draft report and in strengthening the current, final version of the report.

The primary changes between the original draft report and the final are: the inclusion of a new, extensive, formal literature review of the quantitative and qualitative literature on open access, in particular unbundling, and broadband performance and investment; expansion of the price and actual speed measurement benchmarking, as well as a slight refinement of assessing 3G growth; a new, compact review of the critiques of penetration per 100 measurements and responses to them that replaces the original focus on the density critique alone; new extensive case studies of the voluntary models of open access in the Netherlands and Switzerland; and a variety of discrete responses to useful comments we received on specific country studies.

The literature review in Part 4 finds the existing quantitative work to be sparse, often weak, and heavily influenced by industry funded work. We also identified a series of basic, pervasive limitations of cross-country econometric studies of broadband policy and performance. The qualitative work, on the other hand, exhibited less industry sponsorship, was less equivocal, and tended to support our own findings, as we reported them in our draft. This extensive new review replaces the narrower econometrics study we included in the original draft, which tried to highlight some of the same problems we explain in more depth and detail in this final draft by taking two papers on their own terms and data, and highlighting the

specific problems as they were expressed there; we do, however, include a response to the primary critiques of that study in an annex to Part 4.

The new components of the benchmarking study expand the pricing study we conducted and add speed measurements by Akamai to the original Speedtest data we used. Both for prices and for speed, the new, expanded datasets are consistent with our original findings reported in the draft. In particular, our findings on speed find an identical ranking based on a completely different measurement technique and location; and our study of prices suggests an even grimmer picture than did our original findings. We also analyze mobile 3G penetration in terms of new subscribers per 100 inhabitants, rather than purely in terms of percent increase. Here, we find that U.S. growth is less robust by comparison to growth elsewhere compared to looking purely at percent growth from the lower existing base.

In the responses to our draft and in conversations since then, we found that our initial findings were misinterpreted as a recommendation for recreation of the unbundling regime of the late 1990s lock, stock, and barrel. Here, we therefore underscore the ways in which transposition of open access policies to next generation networks is not in fact simple copying, but involves a range of policies, some that rely more on coercive regulation, some that rely on combined municipal funding and supporting regulation, and some that rely primarily on voluntary or quasi-voluntary models. In particular, we added new case studies of the two voluntary or quasi-voluntary models of next generation open-access models: the cases of the KPN-Reggefiber joint venture in the Netherlands, and the case of Swisscom's Fibre Suisse project. Our charge was not to offer policy recommendations. The results of our study certainly could be read to offer strong, clear policy implications, and were misinterpreted in several comments to the draft study as offering specific, narrow, backwards-looking policy recommendations. This was not our intention, and we hope the new sections help to clarify this.

The basic large economies of scale of communications networks have not been repealed by the transition to digital communications networks. The failure of twentieth-century natural monopoly regulation pushed advanced economies everywhere to experiment with different models of achieving competition. The two primary methods have been an effort to leverage cable and telephone convergence: fostering competition between these two platforms in the broadband market; and using new regulatory techniques to enable competition over shared or partially shared infrastructure. These have been complemented in a few places by public investment in the public-utility-like facilities.

The transition to next generation connectivity is heightening the effect of the large economies of scale. In particular, the fiber-to-the-home networks that are likely to dominate future home connectivity involve very high costs of low-tech, labor-intensive elements like digging trenches, placing ducts, and pulling fibers through the walls of subscribers' homes. In the short term, the costs of fiber-to-the-home deployment are several times higher than the cost of cable upgrades to next generation speeds, which require mostly electronic upgrades. In the long term, fiber-to-the-home networks have vastly higher capacity and upgradeability. These facts to some extent undermine the business and technological convergence effects that played so central a role in the first-generation transition by weakening the efficacy of media convergence for sustaining a competitive market in digital media and communications carriage networks.

During the first broadband transition, a major assumption underlying the reliance on facilities-based competition was that cable and telephone infrastructures already in place needed relatively low and largely symmetric cost upgrades to provide Internet services. This meant that, at a minimum, there would be two facilities whose incremental upgrade costs were sufficiently low to be able to compete head-to-head in retail broadband markets. In addition, there were some hopes that the same would be true of power lines and wireless systems. Together these meant that technological convergence could

underwrite competitive markets among players, each of whom invested in—and owned—their own complete facilities.

The necessity of massive physical investments to upgrade copper networks to fiber to the home, and the lower costs for cable to upgrade to next generation capacities, is undermining, to some extent, the comparability of fixed wire modes of access, and therefore the relaxation of natural monopoly characteristics. Furthermore, the vastly greater medium-term capacity of fiber and next generation cable relative to wireless, and the need to build new networks for fiber even where utilities are involved, suggest that alternative telecommunications pathways that are neither cable nor fiber are unlikely to emerge as low cost sources of facilities-based competition in most countries and markets. Together these facts are posing new challenges to policymakers concerned with next generation transition and the market structures that will prevail for next generation connectivity, and the extent to which facilities-based competition among fully-redundant next generation networks can be the core to a country's broadband competition policy.

Many countries with roughly similar, market-based, democratic societies are facing these great challenges of transitioning to next generation connectivity. There is much to learn from the approaches and experiences of other countries facing this common challenge. We hope our work will help the Commission in its planning.

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