

Internet Governance and the “Digital Divide”

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From the outset, a key promise of the Internet was the empowerment of individuals to gain immediate access to a wide variety of knowledge and services. According to the US National Broadband Plan, the deployment of broadband, the enabling infrastructure of Internet communication, “is the great infrastructure challenge of the early 21st century” [4]. In contrast to the capital-intensive industrial economy that shaped the 20th century, the emerging information economy provides users with the tools necessary to “be the authors of their own lives” [3]. Internet access is a driver of economic growth, driving both job creation and opening the doors to global competitiveness previously limited to major economic players. As compelling as this image is, our understanding of the processes that translate from broadband capacity to social outcomes is still in the developmental stages.

This project will explore how the issues of getting from here to there, capacity to outcomes, interact. Two key issues bookend this process: measuring capacity and measuring outcomes. With respect to the former, what are the challenges of deploying and monitoring capacity in the face of highly variable demand? Broadband has increased from 8 million in 2000 to 200 million in 2009, but there are still 100 million Americans that do not have broadband [4]; disentangling the social, economic and technical factors that contribute to broadband and Internet access trends is the challenge in this work.

MEASUREMENT AND DEPLOYMENT

A key aspect to fulfilling the promise of empowerment is an understanding of what the network can handle. A typical measure of network capability is speed¹. Understanding what the total possible load a network can handle is and what kind of bandwidth is available at a given time² is important for measurements of the infrastructure itself, but these measures do not always translate back to user experience. Rather, the Broadband Data Improvement Act has mandated the development of better measures of broadband “capacity” [1]. A number of online speed tests are available as tools or as company related reports: Speedtest.net, Akamai, ComScore, M-Labs, Google’s Youtube service, or FCC tests via broadband.gov. While a step forward, the results of these tests do not tell the same story, highlighting the complexity in measuring speed (or other attributes such as latency) on a heterogeneous network of networks where bottlenecks and load management interdictions may occur both within these networks and at their interfaces [2].

Recently, as part of the Broadband Data Improvement Act (BDIA), the State Broadband Data and Development Program (SBDD) has been implemented to help integrate broadband technologies into local state economies and help collect information about broadband availability. Earlier this year, preliminary data was made available to researchers. On 17 February, a census tract-level broadband map will provide data on availability, speed, and location of broadband services. This dataset will provide a unique opportunity to explore the latest, and one of the most accurate, representations of the digital divide to date. Coupled with a review of Internet technologies and adoption trends, this broadband availability data will be used to investigate this new “view” of the digital divide.

MEASURING OUTCOMES

Network capability is only part of the story. In any governance effort, understanding outcomes is necessary to monitor and improve performance. While infrastructure capabilities are key, project usage outcomes inform deployment decisions, creating a feedback loop between the needs of the constituency

¹This is the typical, conventional measure. An increasingly important measure is latency, which can have a substantive impact on interactive applications even when there is more than sufficient bandwidth available to handle an application’s needs.

²Statistical time period, not a prediction for a particular time period.

and the resources that support service deployment. Measuring outcomes is a necessary component of the feedback loop. The Pew Internet and American Life Project provides a wide array of survey data documenting users' perceptions of Internet access [8], usage practices [9], and barriers to adoption [5], [6]. Beyond the simple assertion that access to technology will empower users, survey data provides key insight into issues such as socioeconomic differences in magnitude and kind of usage, which groups use which devices, and what the barriers to development may be.

PROJECT SELECTION AND DEVELOPMENT

The portrait of Internet Governance and “digital divide” issues presented here is still quite broad. Students are encouraged to investigate the accompanying references to identify topics of interest during the first third of the semester, identify data sources and perform preliminary analyses in the second third, and spend the remainder of the semester developing an analysis that addresses their topic of choice. The course covers three core Engineering System methodologies that will be applied to investigate issues related to Internet governance and the digital divide.

- **System Dynamics** The dynamics of technology adoption are driven by both social and technical factors. Students will review existing models of broadband deployment (drawn from [7]). These will be supplemented with data drawn from user surveys to reason about observed behavior modes and how they contribute to this kind of adoption model.
- **Uncertainty** In any model of adoption, there is an element of uncertainty. For the model above, the uncertainty lies in the current inflection point: early adopters seem to be saturated and new strategies need be developed to reach the rest. Students will re-evaluate the models thus far, identifying key social and technical uncertainties that may drive adoption or stagnation of ongoing broadband deployment.
- **Networks** The Internet is fundamentally a network-of-networks and often the route from user to content crosses more than a few of these privately owned and provisioned networks. A key element in broadband deployment is the cost of infrastructure maintenance and the revenue models of Internet Service Providers (ISPs). These will be presented from a network flow perspective, in particular, illustrating the difficulty of unraveling value-flows and the impact of this uncertainty on network provisioning.

Tying these together, students will use the insights from these models to select and discuss specific issue areas that are affected by these trends.

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