

Measuring Library Broadband Networks for the National Digital Platform

Simmons College, along with partners New America's Open Technology Institute (OTI) and Internet2, are requesting \$569,540 (\$156,457 in cost share in addition) to fund "Measuring Library Broadband Networks for the National Digital Platform," a National Leadership Grant for Libraries research project. The initiative would bring advanced broadband measurement capabilities to inform the capacity of the nation's public libraries to support the online software applications and social and technical infrastructure needed to promote the National Digital Platform (NDP) in U.S. libraries.

National Need: A foundational element of the NDP is a public library's broadband capability. For the past several years, IMLS funded projects have sought to identify public library broadband speeds and services through library staff surveys. This research helped to paint an important picture of our national public library broadband infrastructure, from speeds to services, e.g., public computers and WiFi, to support emerging NDP digital services and capabilities. However, new research techniques now exist to measure both speed and quality of service (QoS) characteristics of library broadband networks. Passive networked devices the size of a pack of cards running open-source broadband measurement platforms, such as Project BisMark, Network Diagnostic Tool, or PerfSonar, can be installed at library broadband ingress sites to monitor and measure broadband speeds and QoS, i.e., latency and jitter, as well as identify the broadband service provider. Further, similar tools can help to detect network neutrality infringements, including throttling and Internet censorship, as well as identifying whether the broadband service provider is limiting QoS and access to websites or online applications. As such, public libraries need access to accurate broadband data and reliable networks to inform their ability to support emerging software applications and other networked services to meet the digital demands of their communities.

The research will investigate the following: (1) advertised versus actual broadband speeds and QoS that public libraries are getting to determine how well the broadband service and infrastructure are supporting their communities' digital needs and (2) further, if public library E-rate funded services are delivering what they are contracted to provide; (3) data on broadband network usage and capacity, along with additional data that would be useful to public libraries in providing their communities with online software applications and social and technical infrastructure; and (4) whether broadband networks are being throttled or degraded in accessing various types of content or applications in public libraries across the U.S.

The answers to these questions can assist public librarians as their institutions continue to evolve in providing a robust broadband foundation for the NDP. The research will also help inform libraries' capacity to support new, QoS sensitive applications, including: 4K streaming, HD video conferencing, virtual reality, and telemedicine. Further, the data collected can help inform key policy issues, including the use of Universal Service Funds/E-Rate and the capabilities of our nation's public libraries to support current and evolving patron needs across diverse communities.

Project Design: Our proposed research framework includes passive, device based testing of broadband network speeds and QoS, as well as primary research on library staff and patrons user experiences to understand and evaluate actual library broadband performance and ability to meet needs. These activities will be accompanied by on-site, in person monitoring of broadband use. The project will contribute additional insights related to the data collection methods used by the University of Maryland's iPAC¹ and leverage the pilot conducted by OTI, which focused on K-12 schools in Alexandria, VA². Further, the project team plans to leverage the combined IMLS grant experiences from the Internet2 "Toward Gigabit Libraries"³ librarian broadband education toolkit and "At the Edges of the NDP: Rural Library Hotspot Lending Programs,"⁴ a research project led by the University of Texas at Austin, Oklahoma State University, and Simmons College to understand how wireless hotspot lending programs can enhance the ways that rural libraries participate in the NDP.

¹ <http://ipac.umd.edu/our-work/public-libraries-internet>

² <https://www.newamerica.org/in-depth/measuring-broadband-alexandrias-schools/>

³ <http://www.dlib.org/dlib/may17/spellman/05spellman.html>

⁴ <http://www.dlib.org/dlib/may17/strover/05strover.html>

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Our project intends to build upon these findings to develop an integrated research and community engagement platform that leverages new technology guided through library community-engaged design principles. Simmons College, as the lead investigator will develop the research framework and protocols, outreach and implementation materials, and provide leadership in the final report. OTI will support the development of the network measurement device, Measurement Lab (M-Lab) open Internet measurement server platform, device management, and data visualization components. Internet2 will provide project management support and aid in the development of outreach materials/surveys and the final report.

Stage 1: (months 0-6)-- Collect Input from Stakeholders and Build Community Engagement Platform

- Host workshop with 10-15 library directors/tech directors and library broadband subject matter experts to: discuss how broadband is used in libraries; canvass other research on this topic; identify what is important to measure; and determine how libraries want to visualize and best utilize the data. Libraries involved with workshop would be initial pilot users.
- Decide on best test platforms, e.g., Bismark, NDT, PerfSonar, and Neubot based on library needs and interest.

Stage 2: (months 6-12)-- Build Device, Outreach and Implementation Materials, and Small Scale Pilot

- Build the device based on existing research findings and focus groups/interviews with librarians--leverage existing measurement platforms based on workshop feedback on elements to measure and test. Build the cloud service where devices are managed and where data is collected and viewed, leveraging the M-Lab server platform.
- Develop outreach and education materials on device and project objectives. Design broadband usage survey for library staff (service provider and cost information, perception of adequacy of broadband), library technical support (actual usage and capacity), and for patrons. Create device implementation and management materials for libraries. Launch small scale, prototype deployment for library feedback, 10-15 libraries in initial target.

Stage 3: (months 12-20)-- Refine Device and Materials and Scale the Pilot

- Further iteration on the device design, management platform, and data visualization platforms based on stage 2 activities.
- Work with State library agencies and research and education networks to identify libraries for wider scale deployment based on initial research findings. Deploy to 50 libraries targeting multiple types: Tribal, Rural, Suburban/Metro, Urban.

Stage 4: (month 20-24)-- Analyze Data Collected via Primary and Secondary Sources

- Research analysis and final report designed to address research questions and offer guidance on how to scale pilot.
- Announce availability of raw data (from devices and surveys) to library and network community for further analysis.

National Impact: The project will deliver both technical products and research outputs that will assist other libraries in measuring their broadband networks to support the NDP. The technical deliverables include the following: an open-source and replicable measurement platform; testing platform; device management system; data visualization system; and measurement devices installed at least 50-60 libraries across the U.S. The project will have the capability to fundamentally change how library broadband is measured and provide more actionable, precise data on broadband performance to both libraries and researchers writ large. Policymakers, as well as taxpayers, will be interested to see if broadband service providers are delivering on the E-Rate funded services they are contracted for. In order to scale, the project will provide hands-on guidance on how to build the low-cost device measurement platform and install it in a library. The research will document the technical processes and software requirements needed to scale the device installations in public libraries across the nation. It will also report on the design processes used with library staff to develop useful and effective interfaces driven by user input from key stakeholders. The deliverables will be useful to researchers, practitioners, and policymakers interested in the social and technical aspects of the project needed to support the NDP.

Budget Summary: Our proposed total project cost is \$725,997, with \$156,457 in Cost Share. Direct costs comprise \$69,327 in Salaries and Wages and Fringe Benefits, \$118,124 in Travel, \$5,900 in Supplies, Materials, and Equipment, \$245,678 in Subawards, \$42,636 in Student Support, and \$49,600 in Other Costs.