Data, Decision-Making, & Design

Visualizing Internet Measurements in Libraries

Simply Secure

INTRODUCTION

Summary

Researching and designing an accessible visualization tool that delivers internet measurement data to public institutions.

The importance of internet measurement

The societal role of the library is ever expanding. While libraries continue to promote lifelong learning and reading for people of all ages, they also work on the front lines of a fraying social safety net. They are a resource for adults facing serious life challenges and stressors, such as housing obstacles, criminal justice proceedings, unemployment, and health crises. To serve their communities, libraries have embraced a pivot to digital. This results in a steady concern for adequate hardware, software, and internet quality.

Currently, there is an imbalance of data access between public institutions, like libraries, and the private telecommunications' industry that serves them. To consistently and automatically measure internet performance, participating libraries installed small measurement devices connected to their library wired and Wi-Fi ports. Our team provided support in user research and design with an aim to deliver internet measurement data to the respective libraries in an accessible format. The visualization tool that would allow the various users to access the data, explore it, and therefore benefit from it. While some applications of the data visualization tool are apparent so far, there are many more to be discovered in the future.

Use cases

1   Libraries can monitor their internet performance independent of their internet service provider.

2   Librarians can use measurement data to determine when it's necessary to upgrade their contracted internet service in order to serve their patrons effectively.

3   Some libraries report annually on the state of their internet, so these measurements could save them valuable time when compiling data, allow for deeper analysis, and provide transparency to their tax payers, benefactors, and governance structures, e.g. boards, senior leadership.

CHALLENGE

Various contexts

Library setups are wide-ranging. Library systems may span several counties, but others occupy a single building in a remote town. This gives communities agency to set up the policies and tools that work for them, but it also presents challenges in designing a tool that can be useful in complex, varied environments.

Presentation of complex data

Visualizations give us a way to understand complex data. How could we design for comprehension with visualizations? There is a fine line between not enough information (it's not useful) and too much information (it's crowded and unreadable). How could we allow for comparison? How could we handle data that seems to refer to the same measure, but has complex technical nuance around its measurement methodology? This information is critical to many users.

Range of user capabilities and interest

Our users range from accomplished librarians to experienced IT professionals. How could we design for multiple types of users? What features are important for each group? Would tooltips distract IT personnel? Would advanced views be confusing to others?

APPROACH

0 | Foundation: Double Diamond
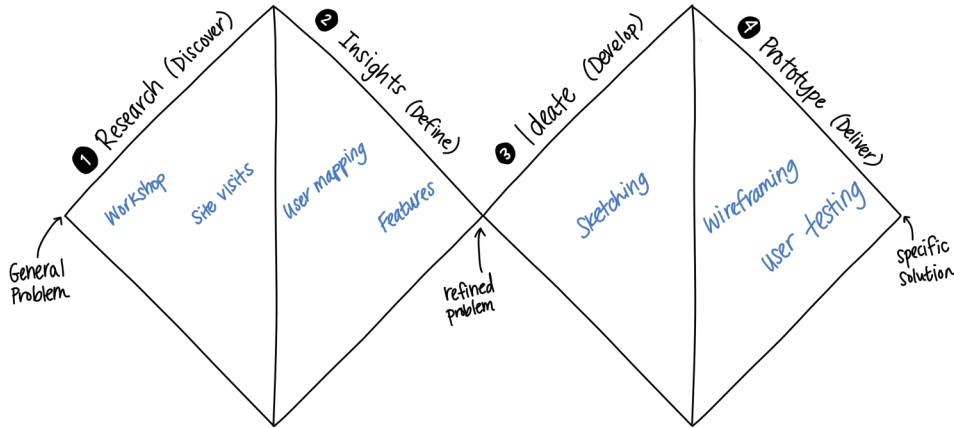
1 | Research: Design Workshop & Immersive Site Visits

To kick off the research process, we held an in-person, 1-day, participatory design convening with 30 librarians from across the US. We learned about the infrastructure, services, and providers at the libraries. This workshop allowed us to begin to understand the diversity of users and contexts, instead of relying on our assumptions of the "average" librarian or library context.

Next, the team conducted ten site visits to libraries across the US. In our conversations with Library Services, IT staff, and other community members, we found that the landscape of issues around providing internet service to the public is broad and interrelated. Our interviews led us to see the overview of librarians' jobs, patron needs, and the models of libraries. By having a clear understanding of the context, we are able to better understand needs and challenges, and create a more useful tool.

2 | Defining Focus: Analyzing User Research

From our research insights, we crafted personas and user flows to communicate the various account types (admin, editor, viewer), define system goals, and plan for features.

Personas

<table>
<tr>
<td>

Librarian

🖥 Workplace: one library branch of a greater system

🖥 Technical abilities: low

👥 Collaborators: IT personnel at library system headquarters

🚀 Goals:
• view data in the tool
• help patrons by understanding the library's internet speeds

</td>
<td>

Library Director

🖥 Workplace: independent library (single location)

🖥 Technical abilities: medium

👥 Collaborators: few to no coworkers — reliance on volunteers and outsourced IT

🚀 Goals:
• edit all library information in the tool   • help patrons
• present data to the library board
• quickly confirm slow connections
• view data over specified times

</td>
</tr>
<tr>
<td>

IT Professional

🖥 Workplace: library system headquarters (multi-branch)

🖥 Technical abilities: high

👥 Collaborators: all users in the library system + ability to manage user accounts

🚀 Goals:
• edit all library information in the tool   • monitor branch issues
• analyze data over specified times   • plan for future tech
• improve their internet system
• present data to director

</td>
<td>

MLBN program administrator

🖥 Workplace: M-Lab

🖥 Technical abilities: high

👥 Collaborators: all users of the tool + ability to manage user accounts

🚀 Goals:
• manage all users/locations/devices   • provide support
• understand MLBN status   • export data
• compare locations
• view nationwide trends over time

</td>
</tr>
</table>

Account types

- Users should be able to view either one location, multiple locations, or all locations.
- User permissions can vary depending on the user's job:
    - Viewer — just an overview of the important information
    - Editor — complete control over their library or library system setup
    - Program Admin — complete control over all libraries and library systems

System goals

- The user can interpret data.
- The user can export data.
- The user knows the measurement system is working.
- The user understands the internet status.
- The user can annotate issues.
- The user can manage the library information, library users, and library devices.

General features

- Login and logout
- Status: to understand the current internet connection status
- Charts: select date range, view by aggregate, view different tests and devices, export
- Notes: to remember and communicate incidents
- Compare: to compare two or more locations on charts
- Locations: to view/edit a list of locations (that the user has access to)
- Library information: to view the information related to the internet and measurement devices
- Users: to view/edit other users of the tool (that the user has permission to access)
- Account: to manage account information

3 | Initial Ideation: Sketches

We evaluated layouts, eliminated concepts, and made comments for subsequent sketching (see green markups). After analyzing sketches, we identified the features outside the scope of version 1, such as an alert system, because they were not core to the functionality of the visualization tool.
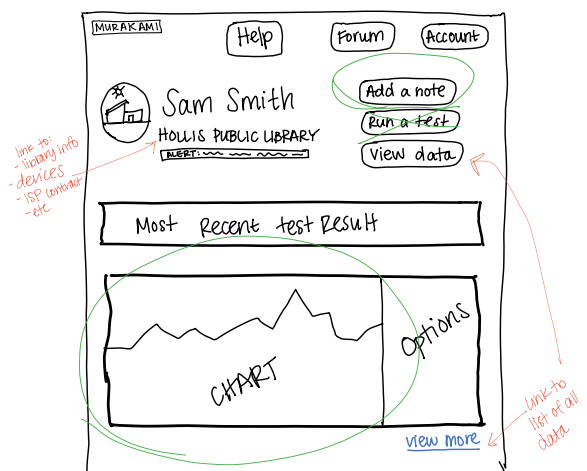

We planned the needs of each screen.
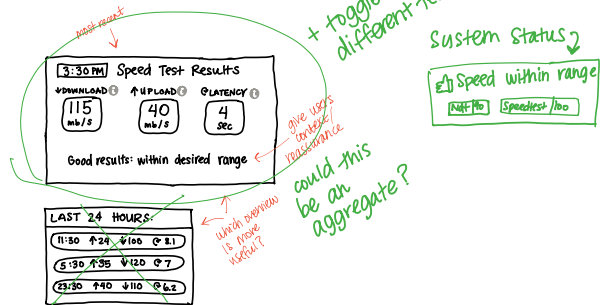
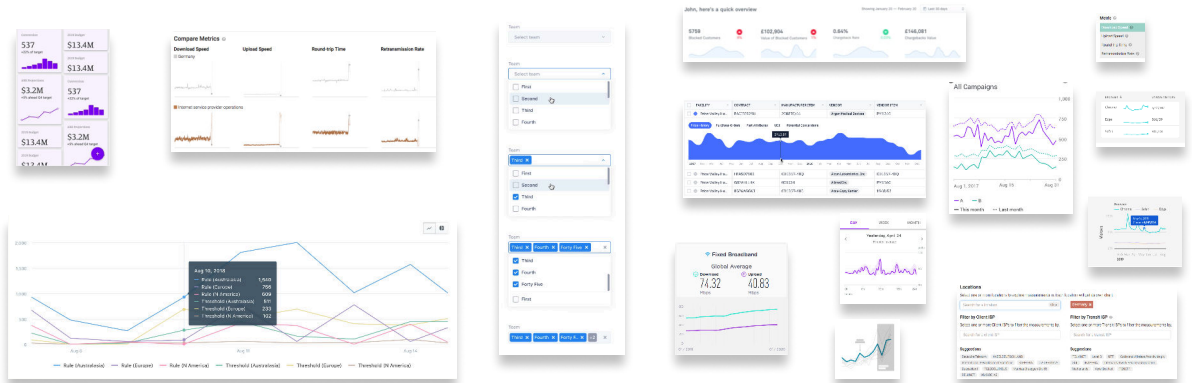*We proposed ways to indicate the internet status.*
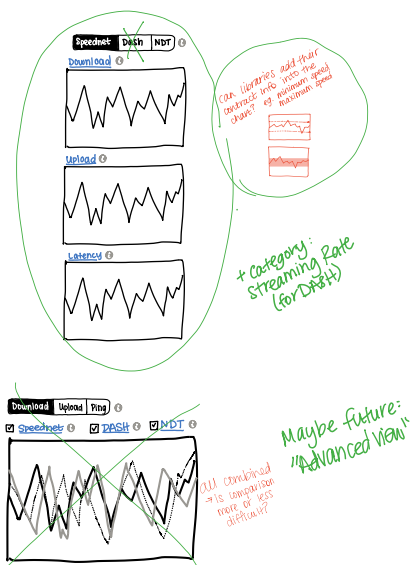
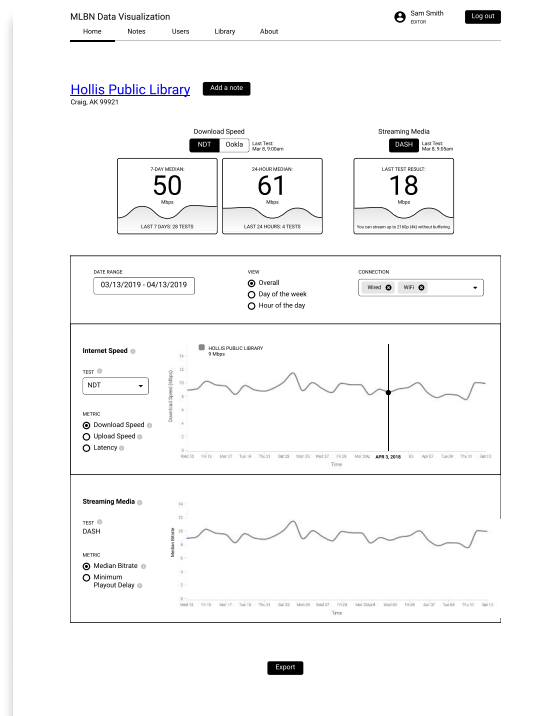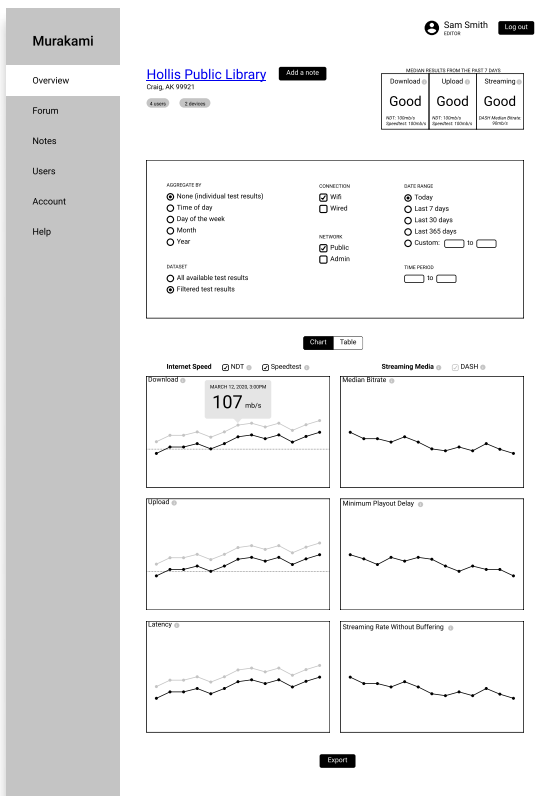*We prioritized simplicity and clarity in the charts.*

We explored the layout of the home screen.

# 4 | Solidifying Structure: Wireframes

Our inspiration board housed images of visualizations and interactions that we collected from various sources. We were able to identify effective patterns and referred to them often.
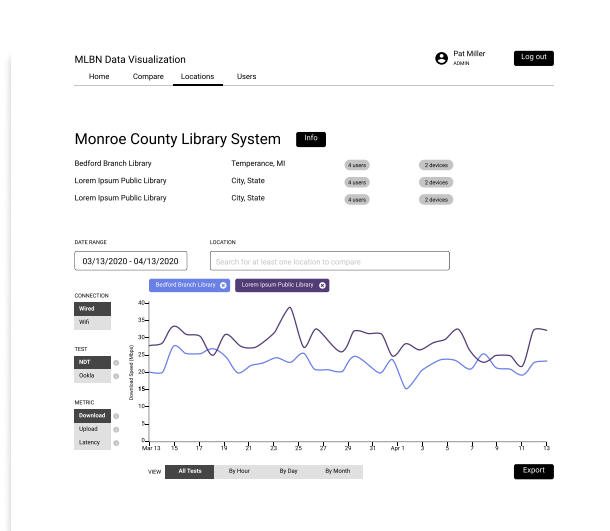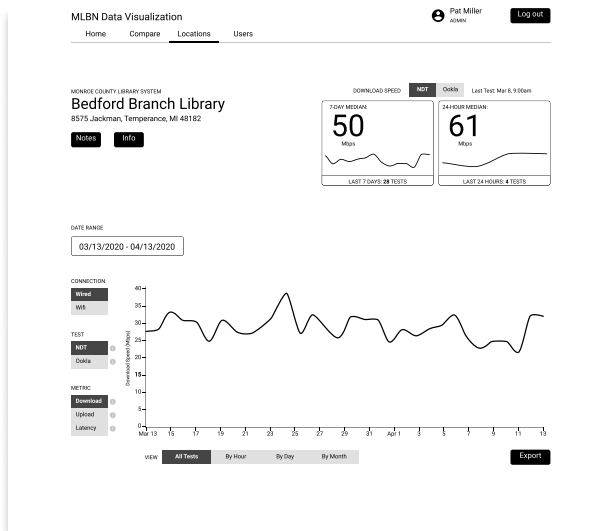

Two early wireframe designs of the homepage exemplify the progress that we made on a weekly basis. In this example we sought to bring the controls closer to the charts.
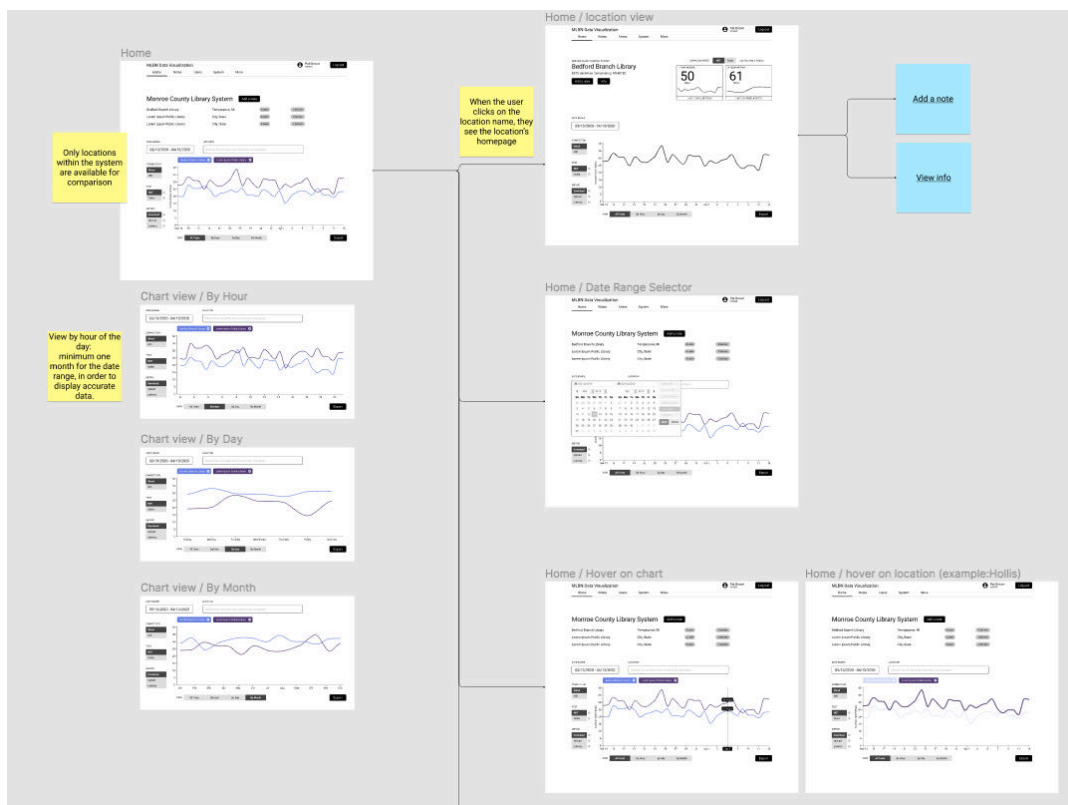
We laid out the screens in a flow to understand the navigation.

After discussions and improvements, we agreed on final wireframes for version 1 testing.
[Shown: viewing a library branch, comparing multiple branches of a library system]

5 | Testing Usability: Prototype

With wireframes as a guide, the development team built a prototype for testing. Eight librarians participated in user testing. Observing users gave us valuable feedback for improvements and validated the core features of the tool. Additionally, we used a portion of the interview time to discuss librarians' concerns about their internet and to get an idea of how the tool would fit into their work.

Plan and Execution

The research plan was guided by our core research questions: what we wanted to understand better, our unanswered questions, and remaining uncertainties. Using a rainbow spreadsheet, we grouped and compared findings in a spreadsheet to understand which ideas were expressed frequently.

*We added takeaways to a spreadsheet and color-coded it by participant to see what patterns emerge.
Then we were able to solidify key findings.*

Key Findings

Uses for data:
  • Their primary interest in the measurement devices seemed to be about access to more data in general.
  • Most participants report that they have little to no connection problems since upgrading to fiber.
  • Most participants reported recently upgrading to Meraki network hardware in their library. They are excited to have network control and detailed metrics.
  • Most participants do not check their internet speed frequently. They only do so if they notice a slow down or when needed for reporting.

On the job:
  • Participants expressed that they generally know how to solve their most frequent problems. They don't face unique problems often.
  • Security is important to IT professionals.
  • Participant responses were mixed about the documentation of technology issues and their processes. Some users said note-taking didn't matter in their jobs. Bigger systems have a digital system, while smaller locations write on paper.

MLBN visualization website:
  • The role of the forum page was confusing to participants and not vital because libraries already have systems in place.
  • Editor and viewer roles are important. However, the viewer role should be simplified to accommodate for the needs of that user type.
  • The prototype version of the quick reference widget (recent status indicator at the top of the homepage) was confusing to all users.
  • The chart options, "All tests, By month, By week, By hour" were not clear. Participants assumed that these were shortcuts to specific timeframes, rather than alternative aggregations and views of the data.

Actionables

We prioritized changes that would be most impactful or easy for the development team to implement. Lower priority items will be a starting point for the research and design of the next version.

Examples of actions taken after version 1 testing (not exhaustive)
  • Add axis labels to charts (Absolutely necessary for chart readability)
  • Change the label "Devices" to "Measurement Devices" ("Devices" is ambiguous)
  • Define terminology of NDT and Ookla with tooltips (it's not common knowledge)
  • Label "logout" button with words, not an icon (an icon is not explicit)

Examples of future features and research (not exhaustive)
  • Show data from multiple connections (wifi, wired) on a single graph
  • On the library tab, add an informational table for the measurement devices
  • Place "view" options (by day, by hour) in the date picker instead of below the chart
  • Allow users to export images of visualizations, not just data
  • Integrate other measurement devices into the dashboard so that MLBN can be a data hub

CONCLUSION

Results

We are happy to announce that the version 1 of the MLBN Visualization website is live and libraries in the pilot program have the ability to view their internet performance data. Our goal was accomplished through a team effort across four organizations. It's rewarding to give our users something that might not only improve their jobs, but the community that they serve. We are excited to see the uses of the data in the future and make improvements through future phases and research.

Lessons Learned

• Whenever there is collaboration, especially remote, there needs to be a documentation system in place. Communication is vital and the design deliverables make an impact on the efficiency of communication. This is where personas, user flows, and sketches come in handy.
• It's hard to design for such a wide array of users, so our research allowed us to identify diverse needs. Research is vital when designing for anyone who is not you.
• Leave your assumptions at the door. One of the several surprising outcomes of the user interviews was discovering that most libraries have quality internet connections. Most reported few to no issues and satisfaction was high. The measurement data will be useful for other important purposes besides troubleshooting.
• Finally, we learned that library workers are a wonderful group of people to work with and we look forward to future collaborations.

Credits

Project Team

Lai Yi Ohlsen, M-Lab   Josh King, Throneless Tech
Chris Ritzo, M-Lab   Rae Gaines, Throneless Tech
Roberto D'Auria, M-Lab   Colin Rhinesmith, Simmons University
Georgia Bullen, Simply Secure   Jo Dutilloy, Simmons University
Kelsey Smith, Simply Secure   Susan Kennedy, Simmons University

About Simply Secure

Simply Secure exists to advance trustworthy technology that protects vulnerable populations. Their work spans capacity building, design support, open research facilitation, and community convening. Read more at simplysecure.org.

A report by Georgia Bullen & Kelsey Smith

For more information about this report, please email us at contact@simplysecure.org.