

**EMBRACING THE POWER OF THE WEB: TRANSFORMING A LOCAL BUSINESS
IN THE DIGITAL AGE**

**OVERCOMING LOW BANDWIDTH IN AN INCREASINGLY ONLINE
EDUCATIONAL WORLD**

An Undergraduate Thesis Portfolio
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Bachelor of Science in Computer Science

By

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SOCIOTECHNICAL SYNTHESIS

In a brief amount of time, the Internet has become a crucial aspect of modern human life, with constant “connection” being necessary to properly participate in everyday responsibilities. Many Americans struggle to access and maintain a stable connection to the Internet, disadvantaging them in the online parts of their lives. The technical work explores how companies and organizations can leverage the Internet to drive business and automate their manual processes while remaining accessible to those without strong Internet connections. The STS research analyzes how online learning can disadvantage American students who lack consistent or stable access to the Internet. Together, the technical and STS research serve to examine the common problem of unstable Internet from two different sides: that of the web developer and that of the end user.

The key bottleneck in delivering data to users over the Internet is their bandwidth, or the amount of information that can be sent at once. By reducing the amount of data that needs to be sent, web developers can reduce the time those with poor connections must wait for webpages to load. The technical report describes an anecdotal experience of building out a web application that assists in the resume creation process for the interns of a Charlottesville-based non-profit, Forge. While describing the architecture of the system, the report also explores various tools that modern web developers can use to reduce load times for users to improve accessibility.

The web application described in the technical report is actively used by Forge to this day, two years after its development. It has significantly improved their business outreach program and reduced the amount of time spent micro-managing interns’ resumes. These results demonstrate the power that the Internet has to accelerate business processes by decentralizing the resume building process and giving agency to the interns. However, this decentralization is only

possible due to the low-bandwidth nature of the application as a result of the accessibility optimizations described within the report.

The STS research seeks to investigate how different social groups of American students are affected by low-bandwidth networks during online learning in the COVID pandemic. It examines how the digital divide present in America has served to exacerbate the education gaps between socioeconomic groups of students. Through an analysis of previous research and available data on the topic of Internet access and schooling, the STS research paper attempts to develop potential solutions to bridge these widening gaps in the context of Law & Callon's Actor-Network Theory.

Significant differences in Internet access between rural and urban communities, and between wealthy and poor communities lead to certain students becoming unable to participate in the online classrooms forced upon them by the COVID pandemic. Compounding this issue is the tendency of Internet service providers to under-report the access that they provide so that they can save money on building additional infrastructure. This results in rural and poor communities getting overlooked when Internet service providers look to expand and improve their broadband networks. Those that seek to address this issue, such as regulatory bodies like the Federal Communications Commission, must begin re-designing the tools that these companies use to report the access that they provide to ensure honesty.

Working on these projects together provided a deeper understanding of how engineers can take steps to address a problem that may otherwise require systemic change. As demonstrated by the ability of the proactive web developer to design a website that is widely accessible regardless of the user's bandwidth, engineers are uniquely situated to create and deploy solutions that may take others years to achieve.

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PROSPECTUS

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