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Networks of Detroit

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in Information Studies

by

Dustin O'Hara

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ABSTRACT OF THE DISSERTATION

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by

Dustin O'Hara

Doctor of Philosophy in Information Studies
University of California, Los Angeles, 2019
Professor Ramesh Srinivasan, Chair

In this dissertation I present three case studies that are illustrative of how heterogeneous factors, including cultural values, institutional policies, and political interests, can inform the design, configuration, and use of internet-related technologies. My analysis builds upon the concept of internet "tussles" (Clark et al. 2005) and, in doing so, I propose an analytic method that I refer to as multi-tussle. Tussles are characterized by conflicting interests between two or more parties that are mediated by the internet. Tussles involve a combination of technical mechanisms and people, and the many ideals and values that motivate their use of the internet. The case studies that I present in this dissertation pull from my fieldwork in Detroit.

The dissertation of Dustin O'Hara is approved.

Paul Dourish

Christopher Kelty

Leah Lievrouw

Ramesh Srinivasan, Committee Chair

University of California, Los Angeles

2019

This dissertation is dedicated to my daughter, Vivien "Scout" O'Hara.

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Acknowledgement

I would like to thank the individuals who made this dissertation possible. In particular, I would like to thank my committee, Ramesh Srinivasan, Leah Lievrouw, Christopher Kelty, and Paul Dourish -- your feedback helped clarify the focus of my research. I would like to thank my advisor Ramesh Srinivasan for his mentorship throughout the doctoral program and the detailed feedback and attention he provided as I wrote the dissertation. I would also like to thank Fabian Wagmister and Jeff Burke for the creative and intellectual mentorship, and friendship, that started when I was an undergraduate student at UCLA.

I would like to thank my friends and family for their curiosity and willingness to talk (and often listen) about Detroit and the internet. And from my time in Detroit, I would like to thank Chris Mccarus and Benjamin Chodoroff, who went out of their way to help me understand their city.

Biography

Dustin O'Hara grew up in Southern California. Much of his youth was spent building imaginary contraptions at home, long days at the beach with family and friends, and many afternoons at his father's graphic design studio. Dustin attended UCLA as an undergraduate student, earning a bachelor's of arts from the Design | Media Arts department in 2007.

Prior to pursuing a PhD Dustin worked on the PBS documentary series Roadtrip Nation, apprenticed at the Green Gulch Zen Buddhist farm, earned an MFA from the Digital Arts New Media program at UC Santa Cruz, and lived in London where he worked with Microsoft as a creative technologist, and was awarded a grant from the Heritage Lottery Fund to direct a new media project exploring the history of a neighborhood park. In 2012, Dustin's daughter Vivien "Scout" O'Hara was born. Now, Dustin enjoys building imaginary contraptions with Scout.

Chapter 1: Introduction

In this dissertation I present three case studies that are illustrative of how heterogeneous factors, including cultural values, institutional policies, and political interests, can inform the design, configuration, and use of internet-related technologies. My analysis builds upon the concept of internet "tussles" (Clark et al. 2005) and, in doing so, I propose an analytic method that I refer to as multi-tussle. Tussles are characterized by conflicting interests between two or more parties that are mediated by the internet. Tussles involve a combination of technical mechanisms and people, and the many ideals and values that motivate their use of the internet. The case studies that I present in this dissertation pull from my fieldwork in Detroit.

At this point the reader might ask, *but why Detroit?* The high level answer to this question is that Detroit's recent history of decline, ongoing struggles, and rapid transformation make it a compelling and useful case study for examining the limitations and unintended consequences of laissez-faire capitalism, liberal democracy, and our collective use and projected aspirations for digital technologies. The 2015 U.S. Census identified Detroit as the poorest major city in the United States, and one of the most economically and racially segregated metro regions in the U.S. ("U.S. Census Bureau" 2018). With one of the highest rates of households without internet access (roughly 40%), Detroit is described as an example of how the "digital divide" is contributing to greater economic inequality (Bach 2017; Kang 2016). But to describe Detroit as without internet is misleading. Reliance on the internet is ubiquitous, and those most typically considered "have-not populations" in the digital divide regularly interact with digital technology. As a topic, internet access is often described in simple binaries, as something one has or does not

have. However, the institutional priorities and system configurations that support internet access are diverse and varied in their design. To illustrate these differences I present three case studies from my time in Detroit, with each involving a combination of interviews, observations, and historic records. The multi-tussle approach offers a analytic framework for managing and thinking through complex heterogeneous cases.

In chapter two, following this introduction, I examine David Clark's tussle argument. Having been involved with internet research since the 1970s, Clark began writing about the tussle concept in the early 2000s as a way of grappling with the consequences of the internet's explosive growth and the diversity of users and conflicting interests that emerged. Clark was particularly concerned with protecting the internet's 'openness,' or ability for anyone to build and release new internet applications. Writing with the internet's 'technical community' in mind, Clark argued that it was important that they, as a professional community, take non-technical factors seriously. Citing actor-network theory (Latour 1990; Callon 1990) and other science and technology studies scholars, Clark argued for a more self-reflexive understanding of the role technologists play in shaping sociotechnical systems and dynamics. Thus, Clark proposed an analytic framework to describe different kinds of internet tussles. This framework involves a dimension of time, which includes design-time, configuration-time, and run-time, followed by a second dimension he refers to as tussle 'space,' which includes economics, trust, and openness. As part of the tussle argument, Clark includes three design principles: (1) contain tussles within modular components to minimize the tussle's impact on other system functions, (2) designing for choice so system administrators or users can define their own preferences, and (3) using open interfaces so system components can be easily replaced. In articulating a set of design principles,

the tussle argument acts as a kind of "boundary-work" (Gieryn 1983) by defining professional values and, thus, disciplinary boundaries and authority over the technical design of the internet.

As a conceptual framework, I adapted the tussle concept in several ways. While Clark examines one tussle at a time, my analysis of qualitative cases involves an awareness of multiple, concurrent, and interlocking tussles. In this way, I adapt the tussle model to organize my analysis of the three case studies I present in the dissertation. I argue that the latter dimension of tussle 'spaces' is better understood as a set of non-exclusive values. That is to say, tussles can involve interconnected and overlapping values. Thus, within design, configuration, and run-time one can find a prioritized set of concurrent tussles that touch on economic, trust, or openness related issues. For instance, in chapters 6 and 7 I discuss how the data collection practices and cloud based architecture of the commercial Meraki WiFi system involves trust issues that are tightly interconnected with economic relations. Similar dynamics are found across all three of the cases. From a system design perspective one could parse these as distinct tussles that involve different technical mechanisms, but from a multi-tussle perspective they are clearly interconnected. While Clark's design principles were written with system designers in mind, they provide a conceptual vocabulary for describing the relationship or comparative differences between cases. And finally, while Clark centers his analysis on technical mechanism, I focus on the cultural values and ideas that inform and motivate the design and use of internet technologies. For instance, in chapter 4, I discuss how notions of community empowerment and economic development informed the work of local activists who were building wireless networks to share internet access, and how their work and wireless networks involved numerous economic and trust related tussles. Such values and ideas can at times be discussed in generalizable terms, but often the nuance of their meaning

and significance comes from an ethnographic understanding of their specificity. In the case of this dissertation the ethnographic site of study is Detroit.

From the summer of 2016 to the spring of 2018 I conducted a series of fieldtrips in Detroit. In chapter three of the dissertation I discuss the role of ethnographic methods, and how ethnographers tend to value cultural diversity and specificity in their study of technology (Star 1999; Coleman 2010; Burrell 2012). The ethnographic approach that animated my research was directly informed by Ramesh Srinivasan's notion that digital networks should be understood as embedded within local assemblages that bring together "offline networks and spaces," older forms of media, and specific economic and political situations (Srinivasan and Fish 2017). Thus, to introduce Detroit as a site of study, chapter three includes an overview of the social history of Detroit, including the recent history of internet access. Discussions of Detroit's history are often characterized by a master-narrative that is composed of three parts, the industrial rise, the eventual decline, and the anticipated reinvention of the city. The social history of Detroit provides greater context for understanding the cultural specificity and significance of observations and interviews from my fieldwork. Setting out to conduct an ethnographic study, much of my research has involved articulating historic narratives that help contextualize and locate the observations and interviews from my fieldwork. With Detroit as the site of study, the dissertation is also connected to an interdisciplinary area of research known as urban ethnography (Jackson 1985). The history of urban ethnography is filled with white middle class men studying urban ghettos, a characterization that could easily be applied to myself. Furthermore, during my fieldwork I found that I was not alone; in fact I was part of a steady stream of visiting researchers who came to Detroit claiming some interest or concern for 'the

community.'

The case studies presented in this dissertation center on observations and interviews from my time in Detroit. This is complemented by historic records that I use to trace macro political and economic forces, such as federal policies, internet-related activism, and market forces, that led to the design and implementation of the specific technologies and systems I witnessed being used in Detroit.

The case studies are representative of activist, public sector, and commercial efforts to support internet access. Such distinctions are fuzzy at best, but remain relevant to the extent that they reflect a specific notion of an urban political economy that emerged from American laissez-faire capitalism and liberal democracy. In chapter 4, the first of the three case studies, I discuss the work of community activists who are building a wireless network in the North End neighborhood of Detroit. I not only examine the aspirations and ideals of these community activists, but I trace the political backstory that involved the U.S. State Department spending millions of dollars on the development and implementation of the wireless toolkit that activists were using in Detroit. In chapter 5 I focus on how neighborhood librarians from the Detroit Public Library work to support internet access and the use of online government services. As part of this case study, I also examine the conceptual and political history of universal service and federal subsidies that brought internet connectivity to nearly all public libraries in the United States. Following the public library case study, in chapter 6, I focus on a group of young men I met outside Burger King, who had phones but no data plans and relied upon the "Whopper WiFi" network, and "Free WiFi" in general, to get online. Here I examine the history and design of the Meraki

wireless system, one of the most popular commercial wireless systems on the market. I discuss how Meraki's capacity to collect detailed behavioral data was leveraged by Burger King when implementing the Whopper WiFi network.

Each case study offers an empirical example of how institutional priorities and cultural contexts inform the design and implementation of internet-related technologies. To evoke the multi-tussle framework, the observations and interviews from Detroit often fall within the configuration and run-time aspects of the case study, while historic records inform the design-time aspects of the case study. Within each designation (design, configuration, and run-time) I identify a prioritized set of concurrent tussles relating to economic, trust, and openness issues. With this model, one can view how priorities evolve as one moves across design, configuration, and run-time. For instance, in the community network case study in chapter 4, trust was a top priority for the system designers who were concerned with protecting the privacy of activists and journalists, but once the wireless system was being used by community activists in Detroit, economic tussles became the primary concern. With the multi-tussle approach, each case study has its own representative signature of tussle patterns.

In the public library case study, the neighborhood librarians, or 'frontline mediators' as they called themselves, worked to support the use of online welfare applications. The role of frontline mediators is illustrative of how tussles can often involve three way mediated relationships. The public library case study is also illustrative of an externalizing economic tussle. State welfare agencies closed their offices and directed their clients to the public library to use online applications. With federally subsidized internet access and the responsive quality of librarians,

the public libraries were able to absorb the externalized costs of welfare service delivery, and thus the role of 'frontline mediators' emerged. Clark describes economic tussles as transactional exchanges, but through my analysis it became necessary to expand the concept of economic tussles to include externalizing and extractive activity. In chapter 6, in the commercial WiFi case study, I argue that the data collection practices associated with the Whopper WiFi network are best characterized as extractive. Legally they are framed as transactional, as a user of their network one accepts that the Whopper WiFi network will collect detailed behavioral data. Yet most users of the network have little to no understanding of the data being collected about them, and there are few legal protections regarding how the data is eventually shared and used among third parties.

The three case studies not only represent different institutional domains, they represent different approaches and visions of what the internet can or should be. This latter point is not simply about the design of technology, but about the cultural norms and policies that govern the use and administration of networked systems. On a more intuitive and metaphoric level, the three case studies trace a vision of the city as a "networked ecology," where institutional priorities and community needs are partially mediated through the use of applications and network infrastructures (Varnelis 2008). The implementation and use of digital networks simultaneously reinforces and augments the urban political economy. In this regard, this dissertation finds that those who have power over providing access to the internet, and in what manner, are critical to understanding the institutional politics and architecture of the city.

The multi-tussle approach provides the conceptual scaffolding for making sense of heterogeneous sociotechnical case studies. On a more foundational level, the multi-tussle approach is a non-deterministic, constructivist vision of technology, one in which values and circumstances inform the decision-making involved with design and use digital technologies. As I discuss in chapter 7, there are limitations to the multi-tussle approach, the sequential quality of design, configuration, and run-time are overstated and do not represent the iterative dynamics of concurrent processes. The distinction and interpretation of economic, trust, and openness tussles can be quite fluid with overlapping and changing qualities. But any analytic framework has its limitations. This is one of the paradoxes of any design; its perceived usefulness is simultaneously the grounds for its limitations and constraints. Despite these limitations, or more accurately *because of* these limitations, the multi-tussle approach offers scholars and technologists a framework for thinking through complex sociotechnical cases. In this dissertation the multi-tussle approach is used for qualitative cases, but it could be operationalized for quantitate methods. In either case, the multi-tussle approach is an adaptable and useful framework for information and technology study scholars or anyone that is interested in the social study of the internet.

In the following chapter I discuss David Clark's notion of internet tussles, historicizing, interpreting, and building upon the concept. In chapter 3 I discuss ethnographic methods and introduce Detroit as a site of study. Chapters 4, 5, and 6 are the case study chapters; chapter 4 is the community activists case study, chapter 5 is the public library case study, and chapter 6 is the commercial WiFi case study. In chapter 7 I provide a multi-tussle analysis of the three case studies and discuss the adaption of the multi-tussle approach, including its application and

limitations. Chapter 8 provides a short conclusion and chapter 9 is a photo essay from my time in Detroit.

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Chapter 2: Internet Tussles – a framework for analyzing heterogeneous networks

In this chapter I examine David Clark's notion of internet tussles. As a researcher and system designer, Clark began working on the internet in the 1970s. Clark is most widely known for an influential paper published in the 1980s that articulated the "end-to-end" argument or concept for how internet protocols should function. Over the course of his career, Clark witnessed the internet grow from an obscure research interest to a central feature of the global political economy. By the early 2000s, Clark began to conceptualize the idea of "internet tussles" as a way of updating the end-to-end argument to account for how values and conflict are mediated and built into the internet (Clark et al. 2005).

I begin this chapter by historicizing Clark's writings on internet tussles by describing the changing circumstances that influenced his initial thinking, the scholarly work the tussle concept builds upon (specifically actor-network theory), and the rhetorical function of his argument and the intended audience for which he was writing. I then examine the analytic framework of the tussle concept, discussing the different dimensions and language used by Clark to conceptualize internet tussles. As part of this discussion, I describe how my use of the tussle concept differs from Clark, and how using the tussle framework to analyze qualitative case studies involved adapting the tussle model.

2.1 Growth in internet use leads to internet tussles

From the 1960s onward, networked computing became a funding priority for the Defense Advanced Research Projects Agency (DARPA) and, later, the National Science Foundation (NSF). With DARPA and NSF funding, the Internet Protocols were primarily developed and

used in the context of universities and government research institutions. The principle objective of the Internet Protocols was the "multiplexed utilization of existing interconnected networks," or, simply put, the networking of networks (Clark 1988). This institutional context is relevant because the community involved in designing the internet was both small and comprised of colleagues who trusted one another. To provide some tangible context, the allocation and routing of internet protocol addresses were largely overseen by a single person, Jon Postel, until his death in the late 1990s. For years, Postel kept printed records of every person or organization that was online.

Despite government funding, the ARPANET did not have the resources necessary to build and own its own physical network, but instead ran on leased AT&T lines. The scholar Tim Wu argues that the internet's design was a byproduct of infrastructural constraints and affordances of telephony. Built to run on the telephone network, the Internet Protocols abstracted the end-to-end communication model of telephony into its own design. As Wu puts it, "the salient reality --- and one that too many observers don't grasp, or overlook --- is that the Internet works over infrastructure that doesn't belong to those using it. The owner is always someone else…" (Wu 2011); he goes on to quote the Internet researcher David Clark's 1984 paper *"End-to-End Arguments in System Design,"* in which Clark and his co-authors argue that making the network protocols nonspecialized would provide greater interpretative flexibility for future protocol and application design. The technology studies scholar Tarleton Gillespie (2006) argues that Clark's 1984 paper marked a critical moment of consensus building in the internet design community. The debate was between a "virtual circuits" model, where intermediary machines would run applications to manage the flow of data, versus a "datagram" network model, where only

endpoints manage data and intermediary machines simply forward information. According to Gillespie, the *"End-to-End Arguments in System Design"* paper also marks the scholarly origin of the phrase "end-to-end" (Saltzer, Reed, and Clark 1984). Gillespie argues that the phrase end-to-end is an example of how engineers not only design systems but corresponding ideas. The end-to-end concept would eventually become widely used by non-technical communities to describe the internet.

At the time, in the 1980s and into the early 1990s, there were a number of digital networks and information services. Paul Dourish refers to these networks as "othernets" and argues that their differences provide the basis for a comparative analysis of the internet (Dourish 2017). One of the distinguishing aspects of the internet was its relative "openness." While getting online required some configurations and technical expertise, the 'end-to-end' design of the internet not only meant the internet was open for new people to join, it meant it was open for them to build upon. With the development of the Hypertext Markup Language, the World Wide Web, and graphic web browsers, the early 1990s marked a period of explosive growth in internet use. According to World Bank data, the number of people using the internet grew from 2.5 million in 1990 to 44 million by 1995, and over 400 million by the year 2000. In the United States the growth in internet use was tied to federal policies that funded internet access at public libraries and schools across the country and the commercialization of internet services. Gillespie argues that through this period of growth in internet use, the phrase end-to-end gained purchase among non-technical communities as a way of describing the 'shape' of the internet. According to Gillespie this process started when "techno futurists such as John Perry Barlow, Nicholas Negroponte, and Howard Rheingold began to loudly proclaim the potential impact of the new

technology in Utopian, technomorphic terms" (Gillespie 2006 p. 441). Idealists at the time imagined a "dramatic and unavoidable revolution in social and political organization, one that would be induced by the Internet and World Wide Web…" (Gillespie 2006 p. 441). Gillespie argues that the internet and end-to-end concept began to be used as metaphors for social arrangements. It was widely believed that the internet had inherent moral content, that its open qualities would act as a democratizing force, aligned with classic liberal concepts of the individual. Within the milieu of internet designers and idealists the phrase 'user empowerment' came to describe a set of design preferences that bridged the technical end-to-end argument with an ideological notion of individual choice. Clark describes user empowerment as a "preference that the user, rather than the service provider or the software provider, be able to pick the applications to run…," and that the right to choose is widely imagined to be a "basic Internet principle." The notion of internet tussles was an attempt to update the influential end-to-end argument. In doing so, the notion of user empowerment directly informed Clark's conceptualization of internet tussles.

By the early 2000s, David Clark published several papers that aimed at updating the 'end-to-end' argument and introducing the concept of internet tussles. Having been involved in internet research since the 1970s, Clark explained how the internet had been "created in simpler times," by a community of researchers and colleagues that shared a "common goal" (Clark et al. 2005 p. 462) The growth and commercialization of the internet brought with it a wide array of stakeholders with diverse and often conflicting interests. "Perhaps the most important consequence of the Internet's success is that the common purpose that launched and nurtured it no longer prevails" (Clark et al. 2005 p. 462). According to Clark the internet was no longer a

"single happy family of people dedicated to universal packet carriage" (Clark et al. 2005 p.462). The success of the internet was certainly reaffirming for those who had spent decades working on it, but it also represented a fundamental change in who was invested in the internet. For those involved in the early design of the internet, and later the World Wide Web, the success of their systems brought with it a shift in perspective; problems that were previously conceptualized as purely technical were now explicitly understood as both social *and* technical. Secondarily, with the explosive growth of the internet, came a desire to articulate a set of values for the 'technical community' that could act as a form of boundary-work, reinforcing their professional authority and autonomy. In this chapter I argue that Clark's concept of internet tussles was an attempt to grapple with these issues. I examine the tussle framework as developed by Clark and, in doing so, draw connections with the cases presented in this dissertation and discuss how I adapted the concept in applying it to qualitative case studies.

2.2 Internet Tussles: Design, Configuration, and Run-time

The term 'tussles' describes how conflicting interests between two or more parties are mediated by the internet. Values are held by people and inscribed into systems, and by that I mean they are active. Tussles involve a dynamic tension of values - intentionality and reaction. In some cases tussles can be explicitly adversarial and part of a dramatic conflict, but often they represent implicit and transactional aspects of everyday life with the internet. Clark published two papers that explicitly discussed the concept of internet tussles, the first was in 2002 and the second in 2005 (Clark et al. 2002; Clark et al. 2005). While the literature cited in the first paper was largely taken from the technical design community, the literature that Clark cites by 2005 reflects a much broader, more interdisciplinary body of work, with special attention given to science and

technology studies (STS) scholars Bruno Latour and Michel Callon. In this regard, the tussle papers argue for a sociotechnical, somewhat self-reflective, perspective within the technical internet design community, one that intentionally looks to adjacent fields to understand the nature of technology. While Clark describes the growth of internet use in the 1990s as the precondition for this shift in perspective, STS concepts (such as actor-network theory) informed Clark's conceptualization of internet tussles. The key insight that Clark takes away from actor-network theory is the idea, or perspective, that human and non-human actors, including digital technology, should be given equal attention as shapers of society. Callon referred to this idea within actor-network theory as "general symmetry" (Callon 1986). Within social fields, the idea that one should use the same analytic approach for human and non-human actors represented a radical ontological shift that challenged common dualities. For the "technical community" that Clark was writing for, the asymmetric duality was focused on technology. By citing actor-network theory, Clark challenges the 'cypherpunk' ideal that values, such as privacy, can be achieved through technology alone. In this regard, Clark argues that tussles are "regulated not just by technical mechanism but by mechanisms such as laws, judges, societal opinion, shared values, and the like. There is no 'final outcome' of these interactions, no stable point, and no acquiescence to a static architectural model" (Clark et al. 2005 p. 462). According to Clark, the internet is defined by such tussles. So while the tussle concept was written with a technical audience in mind, it was influenced by STS literature. Thus, 'importing' the tussle concept into information studies is not so much a matter of translating a foreign concept as it is an acknowledgement of how ideas move across disciplines and domains of expertise and, in doing so, contribute to a more nuanced understanding of the internet.

Citing the science and technology studies scholar and ethnographer Dominique Vinck (Callon 1986), Clark argues that "the design process is one of balancing considerations and resolving tensions to get an acceptable specification… in other words here *the tussle occurs at design time*" (Clark et al. 2005 p. 463) Most large infrastructural projects attempt to revolve tussles during the design process, so when construction eventually begins tensions have ideally been resolved. By contrast, computers are intentionally designed for users to configure to their liking, creating greater flexibility and, thus, configuration and run-time tussles. Clark describes three types of internet tussles: *tussle in design time*, *tussle in configuration*, and *tussle in run-time*. "What is distinctive (though certainly not unique) about the Internet is that the tussle continues in large part while the system is in use. *Tussle occurs at run time.* ... [For] the Internet the process of design and redesign, construction and reconstruction, use and reuse is ongoing" (Clark et al. 2005 p. 463). While the design process informs future tussles, there is an iterative dynamic to how tussles evolve as systems are rebuilt and replaced over time, and it is the distributed heterogeneous quality of run-time tussles that compounds the complexity. Internet tussles represent both a source of dynamism and instability. For every feature of the internet's architecture, and for every community that comes online, one finds emergent tussles, or points of conflict or even adversarial dynamics between two or more parties. For Clark, this leads to a recurring question that he does not have the answer to: how will the internet change? Or more specifically, will the internet's 'open' qualities persist into the future?

While Clark cites a range of scholars from law (Lessig 1999), economics (Katz and Shapiro 1994), and game theory (Von Neumann and Morgenstern 2007; Nash 1950) to describe various perspectives on how one might think about internet tussles, he focuses on Latour and Callon

(Latour 1990; Callon 1990) and actor-network theory as a way of framing the concept of internet tussles, the role of system designers, and his speculations for the future. Clark argues that the widespread use of technology provides society with persistence and stability. While Clark supports his argument with the work of Latour and Callon, the origins of his ideas emerged from the firsthand experience of being part of the early internet research community and then witnessing tremendous growth in internet use. "This idea that 'the network gets harder to change as it grows up' is precisely the implication of the actor network model. Technology in isolation... has nothing to stabilize. It is the whole actor network (as distinct from the Internet as a network of technology) that becomes stable, as all the human and nonhuman actors align and harmonize themselves to common (socio-technical) interfaces" (Clark et al. 2005 p. 464) So with the internet one finds a wide range of human and non-human 'actors,' from the internet protocols, to internet service providers, online applications, "users," lawmakers, and so on. "We see this whole network becoming more durable to the extent that the actors commit to each other with the technology as a central anchor in this network" (Clark et al. 2005 p. 464).

According to Clark, one of the reasons why the internet is still changeable is because the actor network surrounding the internet is changing. "These tussles arise… because the open architecture of the Internet allows the continuous entry of new players into the actor network" (Clark et al. 2005 p. 465). The arrival of new communities with diverse perspectives and values creates a 'churn' in the actor network. This can involve well-established and stable actor networks, such as the telephone system's embrace of voice over IP, so that "the key issue is not a collision of technologies, but a collision between large, heterogeneous actor networks" (Clark et al. 2005 p. 466) Clark argues that this observation suggests a more complex claim about the

durability and plasticity of the internet. "It is not just that the open nature of the Internet allows new applications and capabilities to be added to the network. It is that the new applications bring new actors to the actor network, which keeps the actor network from becoming frozen, which in turn permits change to occur" (Clark et al. 2005 p. 466). As I mentioned above, this leads Clark to the recurring unanswerable question of whether the current 'open' and 'dynamic' internet will persist into the future. Clark speculates that, as the introduction of new applications and user groups slows and eventually ceases, the actor network will become 'fixed' and the tussles that make the internet changeable will freeze, creating a "durably formed and unchangeable internet" (Clark et al. 2005 p. 466). On a practical level, Clark's assessment of durability seems reasonable, but one of the shortcomings of his notion of a 'fixed' actor network is the assumption that social groups, political and legal structures, and cultural values will remain stable.

Design principles and professional boundary-work

Writing for an intended audience of engineers and technologists, Clark argues that designing technology comes with a 'special power' to create components of the techno-social fabric that can potentially structure and stabilize social dynamics. System designers are simultaneously actors within ongoing tussles and decision-makers who 'shape' the nature of internet tussles that might come later. In the context of actor-network theory, Callon describes this dual function of simultaneously solving technical and social problems as "sociologist engineers" (Callon 1987). According to Clark, system designers have traditionally responded to internet tussles in three ways. The first approach is to assume tussles can be resolved outside the technical system. "Current TCP congestion control provides an example. TCP… 'works' when, and only when, the majority of end-systems both participate and follow a common set of rules. This strategy places

great weight on social pressure to 'resolve' the tussle outside the scope of the technical system" (Clark et al. 2005 p. 465). The second approach is to assume there is "one right answer" and "build technical systems that are more resistant to those that perceive the answer differently" (Clark et al. 2005 p. 465). Finally, the third approach is to separate mechanism from policy. "Policy languages serve two functions. Explicitly, they allow actors to express their own constraints and requirements within a larger actor space. Implicitly, by imposing an ontology on what can be expressed, they *bound* the tussle that can be expressed within defined limits" (Clark et al. 2005 p. 465). According to Clark, this latter approach does not resolve tussles so much as it attempts to accommodate them. The idea of separating policy from mechanism would become the foundation for Clark's tussle-related design principles, specifically the idea of 'design for choice,' with Clark suggesting that system designers push decision-making to users and organizations, enabling them to express their own preferences.

In keeping with the genre of technical engineering papers, Clark's end-to-end argument and the concept of internet tussles involve a set of design principles. The two general dimensions of the end-to-end argument were innovation and reliability. With these goals, Clark and his colleagues argued that mechanisms should not be placed 'in' the network if they can be placed at the 'end node,' and that the network should provide a general service that is not tailored to a specific application. This produces a degree of transparency, where packets go in and come out, and that is all. Referencing the popular adoption of firewalls, content filtering, web caching, and so on, Clark argues that the growth in internet use has involved a slow erosion of the end-to-end argument. Thus, Clark uses the concept of internet tussles to update the end-to-end argument, proposing a new set of design principles: (a) containing tussles within modular components to

minimize the tussle's impact on other system functions, (b) designing for choice so system administrators or users can define their own preferences, and (c) using open interfaces so modular components can be easily replaced -- not only by designers, but by users. Clark acknowledges the limitations of separating mechanism from policy. "[In] principle there is no pure separation of policy from mechanism." Policy languages involve the creation of imperfect tussle ontologies. However, these limitations do not negate the principle of designing for choice. Clark suggests that system designers have a choice between taking a firm position and attempting to embed their values into the system they are designing, or designing for choice, which is in itself a value-laden choice. Clark and his co-authors acknowledge that they are expressing their own values, which are tied to a vision of an 'open' internet and implicitly aligned with the goal of 'user empowerment,' which they suggest is tantamount to user choice.

As an ideological argument, the tussle design principles act as a form of "boundary-work" (Gieryn 1983). Thomas Gieryn argues that boundary-work is a rhetorical style that is used to articulate and defend professional or disciplinary boundaries, autonomy, and authority. The success of internet adoption is a double-edged sword. On the one hand it is a story of immense success; within a few decades the internet went from being a research curiosity that few people cared about to being a central feature of contemporary life. The internet's success solidified the prestige and intellectual authority of their accomplishments but, at the same time, the wild success of the internet also meant that their inventions were now subject to the interests and concerns of society at large. And like any story of widespread cultural adoption, their baby was no long theirs, it belonged to the world. When David Clark was inducted into the Internet Hall of Fame (which is its own form of boundary-work), he recorded a short message using the webcam

on his office computer and published the video onto YouTube. In the video, he expressed his gratitude and explained:

> *"When I began working on the Internet in the mid-1970s, we certainly did not imagine that the future would look the way it does [today]. …. If I can use this moment to make just one point, the future of the Internet is not defined by technologists, it is defined by the rich interplay between technology and the larger context of economic investment, regulatory theories, social, cultural, and political concerns. It's a challenge for the technical community to understand these other factors, but they are the ones that are now driving the future. That is where we must go if we hope to have a role shaping the future. I still believe the internet can be shaped by smart people, and that is the challenge we should accept." (David Clark 2013)*

In this regard, the tussle papers are a response to his own call for action, and in doing so, a form of boundary-work that aims to defend the professional authority of the "technical community." The ideal of separating mechanism from policy is itself an argument for maintaining a notion of professional autonomy and neutrality from the societal tensions that define internet tussles. There is, however, an implicit tension that is nearly a paradox between the desire to model and formalize tussles into design specifications that can manage or accommodate conflict, while simultaneously acknowledging that tussles are in large part defined by societal forces that are difficult, if not impossible, to predictively model. From her study of online gig economies and crowd-work platforms, Mary Gray describes a similar dynamic that she refers to as *the paradox of automation's last mile* (Gray and Suri 2019). Gray argues that what we choose to automate is a cultural question, which means complete or full automation is a moving target, if not impossible. In the case of internet tussles, the impossibility of modeling most tussles is tied to the

complexity and heterogeneity of the actor networks that rely upon the internet, limiting the influence of any one group or institution.

2.3 "Tussle spaces" another name for values

Thus far I discussed how tussle design principles were meant to update the end-to-end argument while also acting as a form of "boundary-work" that could distinguish the technical community's professional autonomy and authority over the internet. The values expressed in tussle design principles reaffirm the ideal of an "open" internet while acknowledging the challenges of mistrust and conflict – the defining qualities of internet tussles. I discussed the three types of internet tussles: design, configuration, and run-time. While design, configuration, and run-time tussles can be understood as sequential, they are, in practice, part of an ongoing iterative cycle, where system components are redesigned, replaced, and rebuilt to meet evolving needs. Design tussles tend to involve system designers who have some combination of empirical and speculative information about how the systems they are designing will be used. Clark suggests that system designers have a 'special power' that can shape future run-time tussles. One of the defining qualities of the internet is its capacity for run-time tussles that are embedded in people's lives. As a system designer, Clark treats internet tussles as a problem to be solved, inhabiting a tension between an acknowledgment that societal dynamics are complex and difficult to understand, and the simultaneous desire to create formalized tussle models that can inform the design of new technologies. But the heterogeneity and complexity of run-time tussles means any one institution or community has a rather limited capacity to manage tussles. Besides a generalizable notion of internet-mediated conflict, tussles describe an actor-network of human relationships, intentionality, agency, and system affordances. The concept of internet tussles

describes generalizable expressions of agency that are bound to systems that constrain and define the grammar, or range of possibilities, of such agency. To provide descriptive boundaries to such a wide range of possibilities, Clark adds another dimension to the tussle concept, which he refers to as 'tussle spaces.' The tussle spaces that Clark describes include: (a) economic tussles, (b) tussles over trust, and (c) the openness of the internet itself. By using the word 'spaces,' Clark evokes a metaphor of physical or geographic space that obfuscates the fact that tussle spaces are another name for values. Thus, economic, trust, and openness tussles are a descriptive attribute of human intention that can change over time and are not mutually exclusive. For instance, while Clark describes corporate data collection as a trust-based tussle, one could easily describe it as an economic tussle, or as having become an economic tussle in the intervening years since the tussle paper was published.

Clark uses the tussle framework to organize and describe technical problems and corresponding areas of research for system designers. In doing so, he tends to focus on one discrete tussle at a time. I have used the tussle concept to organize my ethnographic observations and findings. The most notable shift in applying the tussle concept to qualitative research has involved foregrounding multiple tussles at once. I refer to this as the *multi-tussle,* which includes an awareness of how tussles are prioritized, and how these dynamics change as technologies/systems/policies move from being conceptualized and designed by one group of people to being configured and used by another. Tussles take place within dynamic and culturally diverse actor-networks that involve embodied and lived places where internet technologies act as one of many factors in how political power is understood and organized.

Economic tussles

Most internet service providers are profit-driven; even most municipal or non-profit service providers involve customers paying a service fee. Service providers, be it an ISP or application provider, compete within a marketplace and look to their customers as a source of revenue. "Providers tussle as they compete, and consumers tussle with providers to get the service they want at a low price" (Clark et al. 2005 p. 468). For every tussle space Clark draws clear connections to different design principles. In the economic domain, Clark argues that the principle of designing for choice is a basic building block of market competition, which he contends will drive innovation and discipline the market, ensuring efficiency. Examining the history of internet service providers in Detroit, one finds recurring predictable dynamics. There is the initial economic investment and design decisions of where and when to build network infrastructure, a process that is much more akin to classic construction. Once systems are in place, one finds ongoing run-time economic tussles regarding the cost of service delivery. Such tussles reside along the edges of the network, where users or other networks interface with the service provider. One also finds similar economic tussles surrounding the use of applications and higher-level networked services. In most cases there is a transactional quality to economic tussles, and this is what Clark focuses his attention on. I argue that the notion of economic tussles also includes clear directionality, involving the extraction or theft of information or systems, or the externalizing of costs onto others. The case chapters I present in this dissertation illustrate examples of transactional, extractive, and externalizing economic tussles. For instance, in chapter four I discuss how activists involved in building a wireless community network are caught in a transactional economic tussle with two commercial internet service providers operating in Detroit. In chapter five I explore how public librarians support the use of online

welfare applications and how their work is a byproduct of welfare agencies using online applications to externalize the costs of service delivery onto local libraries. And in chapter six I discuss how Burger King's Whopper WiFi, and the Meraki WiFi system upon which it was built, provide an example of how collecting behavioral data can be illustrative of an extractive economic tussle.

Trust

For Clark the issue of trust or mistrust is directly tied to the growth in internet use in the 1990s. "The users of the Internet no longer represent a single community with common motivation and shared trust. There are parties with adverse interests, and some genuine 'bad guys' out there" (Clark et al. 2005 p. 470). Clark suggests that the principle of 'tussle isolation' is particularly relevant to the issues that fall under the topic of trust. The two trust issues that Clark identifies are "control over which parties are willing to exchange packets with each other," followed by the issue of identity, the need to authenticate identities, and desire for anonymity (Clark et al. 2005 p. 470). For the issue of identity, Clark argues for localized, contained systems, suggesting that a global internet-wide identity system would not be trustworthy, nor would it reflect the many ways in which people choose to identify. Regarding control of network traffic, Clark discusses the proliferation of fire-walls, arguing that fire-walls have changed the internet from a "transparent packet carriage," into a "that which is not permitted is forbidden" network. "This is a total reversal of the Internet philosophy, but pure transparency is not what most users long for" (Clark et al. 2005 p. 470). From my studies in Detroit, the administration of fire-walls is a common approach for maintaining security, but it also represents a set of *possible* tussles between users and the local/regional network administrators that establish fire-wall policies on

behalf of their clients. I say *possible* because, while I never encountered it as an issue, it remains a tacit aspect of the trusted relationship between client and service provider. In an interview I conducted with Clark, the concept of trust tussles was clearly at the center of surveillance conducted by intelligence agencies and affiliated actors. In this regard, Clark described trust-based tussles as often at the center of broad ideological and political conflicts. The case study presented in Chapter four illustrates this point. In response to the Arab spring, the U.S. State Department funded open source developers who made protecting digital privacy (i.e. a trust tussle) a top priority. The systems they were working on were eventually packaged as "Commotion wireless" and would end up being used by activists in Detroit. But once the Commotion wireless system was being implemented in Detroit, the top priority became economic, followed by concerns regarding trust. While Clark focuses his trust analysis on technical mechanisms and systems, I extend the trust tussle to include a more generalizable concept of appropriate behavior, as well as the cultural and legal strategies that are used to manage and police behavior.

The Tussles of Openness

One of the motivating fears behind the tussle concept is that the internet will lose its "open" qualities - the "openness to innovation—to new applications and new uses," the openness for users to browse the web freely and access information as they please, and the openness for people to select services that best meet their needs (Clark et al. 2005 p. 471). Clark characterizes openness as a distribution of power that is aligned with the notion of user empowerment. Whether one is focused on the roles of system designers, administrators, or end-users, openness acts as a precondition for expressions of networked agency that are both predefined and

emergent. In this regard, openness is not a clear virtue for service providers, as it can lead to competition. As Clark explains, "industry understands that interfaces, or lack thereof, can shape a market" (Clark et al. 2005 p. 471). For these reasons, Clark argues for the design principle of open interfaces so that modular components can be replaced and innovations can evolve. While vertical integration (or bundling together infrastructure with higher-level services) necessitates a more closed system, Clark argues that vertical integration does not preclude open interfaces. In the intervening years since the tussle papers were published in 2002 and 2005, the monopolization of online services has had a notable impact on the openness issue Clark describes. By the late 2000s, centralized web services and cloud computing became the industry standard. Amazon Web Services enabled companies and governments to outsource their computing infrastructure and security. There are parallels between cloud computing and the history of mainframe computers, but Nicholas Carr argues that the growth in cloud computing is more analogous to the rollout of the nineteenth century electric grid (Carr 2013). With the introduction of the electric grid, industrial manufacturers that once had to spend a tremendous amount of time and money producing their own electricity could now purchase electricity for far cheaper than they could ever produce it themselves, enabling them to focus their resources on the heart of their production. Similarly, Carr argues that the switch to cloud computing enabled firms and organizations to outsource their computing infrastructure and focus on the design of applications and services that were central to their mission. From a multi-tussle perspective, we find that economic and trust tussles can either align or push up against notions of openness.

Yochai Benkler theorizes cloud computing as a "point of control" within a constellation of points that compose the contemporary power structures of the internet. Benkler "diagnoses" five points

of control, the gatekeeper dynamics of the "app store" model of mobile phones, the centralized authority and risks of "cloud" computing, the behavioral feedback dynamics of "big data," the integration of copyright into system and file format standards, and the monopoly economics of network service providers (Benkler 2016). According to Benkler the points of power are codependent and tightly interwoven. For instance, the Meraki wireless system I discuss in chapter six pioneered the use of WiFi as an instrument for collecting behavioral data. The Meraki cloud and 'dashboard' that facilitates large scale data collection, analysis, and exchange, is partially dependent upon Amazon web services for the storage of their clients' data. The Meraki dashboard leverages the capacities of centralized web services to enable Meraki clients to create custom information policies for networks across many locations, 17,000+ locations in the case of Burger King's Whopper WiFi network (discussed in chapter six). While there are clear economic and trust-based incentives tied to the scalability of centralized web services, inversely, I discuss in chapter four how concerns over privacy motivated the designers of the Commotion wireless system to resists cloud services, opting to run locally-hosted services instead. The challenge with openness as a value is that it is rather vague and often evoked as part of a reactionary response to something that is perceived to limit openness. While all three of the tussle spaces or values are interconnected, the ambiguity of openness often means it is easier to describe how economic and trust issues constrain or limit openness.

2.4 Conclusion

In this chapter I have discussed David Clark's notion of internet tussles. Clark describes internet tussles as taking place within design, configuration, and run-time; arguing that one of the internet's distinct qualities is its ability to mediate ongoing run-time tussles that are embedded

within heterogeneous actor-networks. Adding a second dimension to the tussle concept, Clark describes economic, trust, and openness tussle 'spaces.' Using the tussle model, Clark argues for a set of design principles, and in doing so describes a set of values and ideals for how internet technologies are designed, and the roles and responsibilities of system designers. Regarding this latter point, Clark's notion of internet tussles operates as a form of boundary-work, delineating the professional authority and autonomy of the 'technical community.' While Clark's formulation of the tussle concept is written for a technical audience, he looks to science and technology studies, specifically actor-network theory, as a way of understanding technology. In doing so, Clark challenges system engineers to embrace a more self-reflexive understanding of their own role as designers and the values and biases that inform their decision-making. Thus, importing the concept of internet tussles from a technical engineering discourse to an information studies dissertation is less a matter of translating a foreign concept, and more an acknowledgment of how influential ideas traverse adjacent fields, creating concepts and areas of study that necessitate interdisciplinary perspectives.

In applying the tussle concept to qualitative research, my approach to the tussle concept differs from Clark in several distinct ways. What Clark refers to as tussle 'spaces,' (economic, trust, and openness) I prefer to describe as 'values.' Qualitative cases tend to foreground multiple tussles at once, or what I have come to refer to as *multi-tussle.* The multi-tussle involves an awareness of how multiple tussles are at play within heterogeneous networks. One finds concurrent tussles that tie different actors together within a given case. This often involves three way, or multi-actor mediated networked relations. The tussles are prioritized by those at the center of the case. Following a case study across design, configuration, and run-time, one finds even greater

heterogeneity, with the possibility of new actors and changing arrangements and prioritization over time. By tracing these changes across design, configuration, and run-time, the multi-tussle approach provides an analytic framework for examining how certain technologies and actor-networks come into being, and how they perform over time. And, finally, as a system designer Clark approaches the idea of tussles as a problem that can and should be solved. This perspective is in part tied to the assumption that political economies and communities will remain stable. By contrast, I imagine internet tussles as part of an ongoing process that has no clear end. The tussle concept provides an analytic framework for describing and analyzing heterogeneous networks.

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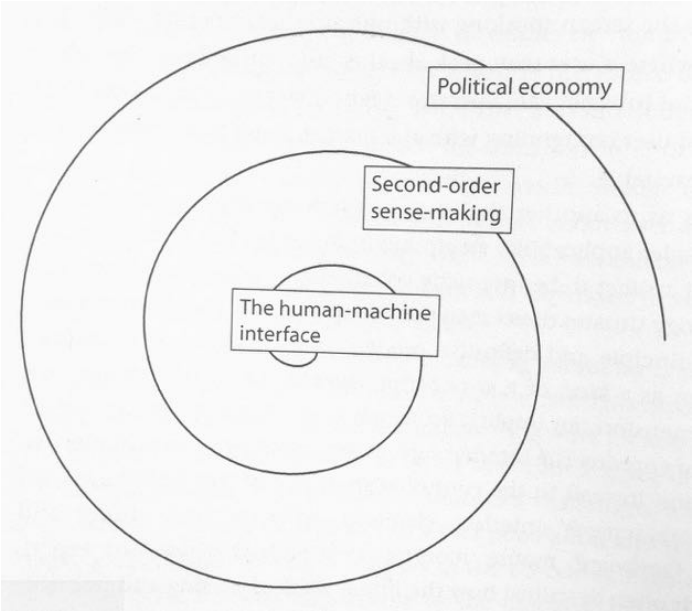
Chapter 3: Ethnographic Methods

It is common for digital technologies to be described with language that evokes a universalist myth. Phrases like the "worldwide web" and "cyber space" are stand out examples. As a counterpoint to this common universalist language surrounding technology, ethnographers tend to value specificity and cultural diversity while studying the interaction and use of technologies. I start this chapter by discussing how ethnographic methods have been used for both the academic and applied study of digital technologies. This is followed by a discussion of "urban ethnography," an interdisciplinary body of scholarship implicitly tied to this dissertation.

3.1 Ethnographic Methods in Information Studies

The scholar Susan Leigh Star argues that ethnographic methods should be used to study information infrastructures. Star proposes that ethnographers identify the master narratives that surround infrastructures. "Many information systems employ what literary theorists would call a master narrative or a single voice that does not problematize diversity. … Listening for the master narrative and identifying it as such means identifying first with that which has been made other, or unnamed" (Star, 1999, page 385). Star suggests that ethnographers "surface invisible work" and examine the "tiny barriers" that keep people from using systems. Throughout the dissertation I discuss master narratives that are used to describe the significance of the internet and cultural identity and history of Detroit. Additionally, I find the idea of surfacing invisible work and identifying master narratives to be a kind of north star for how I imagine and evaluate my own role as an ethnographer.

While Star uses the notion of master narrative as a way of talking about power and bias in technology, the ethnographer Jenna Burrell examines how storytelling functions as a form of sense-making (Burrell 2012). In a study of internet café users in Ghana, Burrell describes narrative sense-making as part of a "material-semiotic model of user behavior, interpretation, and agency." To illustrate her model, Burrell uses a spiral, with "human-machine interface" at the center, followed by "second-order sense-making," and then by the "political economy" located along the outer edges of the spiral.



Jenna Burrell, 2012

The spiral is meant to evoke a non-hierarchical transversal of perspectives. Emotive and analytic, the schema provides a structure for thinking. With the human-machine interface at the center, Burrell's argument is in some ways an attempt at injecting a non-positivist epistemology into the field of human-computer interaction (HCI). As an interdisciplinary area of study, HCI has been criticized for its positivist ideals and narrow approach towards ethnographic and social science methods as a means of producing design recommendations and actionable insights (Dourish

2007). By contrast, a non-positivist perspective might foreground the inter-subjective dynamics of interpretation and the "cultural significance" of digital technology (Kelty 2008). Burrell uses the phrase "second-order sense-making" as a way of describing the cultural practices and storytelling that people use to make sense of computers and the internet, potentially motivating them to use the internet for the first time (2012, page 20). As part of her spiral schema, Burrell argues that "political economy" informs the stories and motivations that drive internet use. I build upon Burrell and Star's approach by contextualizing my ethnographic vignettes with historic narratives that examine the institutional contexts, priorities, and motivations that influenced the conceptualization and design of specific technologies and systems being used at the sites. Christina Wasson and Susan Squires argue that ethnographers studying technology and design share a common appreciation for cultural specificity and diversity that informs their understanding of digital technologies. They argue that ethnographers of technology act as counterpoint to the "universalist globalization logic" that dominates popular discourse surrounding digital technologies (Wasson and Squires 2012). Similar arguments frame this tension as a matter of hegemony and resistance (Srinivasan 2017; 2013). In their book *After the internet,* Ramesh Srinivasan and Adam Fish suggest that digital networks should be understood as embedded within local assemblages.

> What we propose … that the internet and digital networks be seen as part of an assemblage that brings together *offline networks and spaces, "older" media* such as television and radio, *economic and political situations*, and *physical bodies* in shaping political activism. (Srinivasan and Fish 2017)

Srinivasan and Fish propose a perspective and understanding of the internet informed by their own ethnographic research. Srinivasan suggests that in studying the use of technology and media

in diverse and marginalized communities, one might locate alternative imaginaries that have potential to resist the hegemonic power that underpins universalist notions of digital technology. In this regard cultural diversity and specificity become a way of locating a hopeful and emancipatory vision of technology as a form of social imagination.

This dissertation builds upon Srinivasan's argument and ethnographic approach, and involves a "thick" description of the historic, economic, and cultural specificity of each case study. In doing so, the dissertation aims to challenge common myths that the internet as singular and transcendent. Instead, I describe how network systems are embedded within institutional and social ecologies, creating emergent collaborative dynamics while simultaneously reinforcing dominate architectures of power. In the next part of the chapter, I reflect upon my ethnographic process and how Detroit as a site of study informed my approach and analysis.

3.2 Ethnographic Site & Fieldwork

A doctoral student from the University of California, Los Angeles, I arrived in Detroit for the first time in July of 2016 to conduct an ethnographic study. Over the course of one and a half years I visited Detroit seven times, spending a total of 75 days in the city. While my ethnographic approach was grounded in participant observation, I conducted informal and semi-structured interviews. Initially my process was very open ended and exploratory in nature. This involved me revising my assumptions and understanding of Detroit, and actively reflecting upon what I was doing there and what the dissertation was about.

Prior to the first trip, I had spent months reading through websites, blogs, and zines created by Detroit activists and technologists, documenting their efforts to build wireless networks. From afar, these efforts seemed to epitomize the cooperative ideals of what the internet could be. But upon arriving in Detroit, I realized I had internalized an ideal narrative. I was not alone in doing so. The Vice publication *Motherboard* featured some of these same activists in a short documentary and series of articles that described their work as a model for community-owned networks. Contrary to Vice's coverage, I found that fast food restaurants and the public library branches were providing far more consistent internet access to low-income communities living in Detroit. Furthermore, the activists hosting community networks remained dependent upon the main internet service providers. It became clear that discussing wireless community networks in isolation was to ignore the true complexities of the situation. I decided it was necessary to write several case studies that, together, would be at least *partially* representative of this complexity. Thus I began focusing on how internet access, or "Free WiFi," was being used across activist, public sector, and commercial settings. In this regard, the organizational logic of the dissertation was informed by a notion of the city that is particular to the political economy of the United States (Fraser 2017; Smith and Kirkpatrick 2017).

By using ethnographic methods in an urban context, the dissertation is connected to the interdisciplinary body of scholarship known as urban ethnography. As an interdisciplinary area of study, urban ethnography has an origin story that is tied to early twentieth-century sociology at the University of Chicago. Robert Park and other urban sociologists from the University became known for their study of human ecology and the idea that the city was an expression of modernity. It was argued that heterogeneous urban populations produced greater "instability and

insecurity" (Wirth 1938). In contrast with rural communities that were governed by interpersonal relationships and cultural rituals, the twentieth century city was an impersonal and rationalized society (Goldberg 2012). With this argument came a behaviorist perspective focused on how the built environment informed social dynamics. In his 1928 paper, *Human Migration and the Marginal Man,* Park explained that: "[in] these great cities, where all the passions, all the energies of mankind are released, we are in a position to investigate the process of civilization, as it were, under a microscope" (Park 1928). Park and the Chicago school of urban sociology were influential in academic and popular perception of inner cities formalizing cultural notions of poverty and race in the United States. By the 1970s, Park and Chicago school were criticized for their "tacit Social Darwinism and for their uncritical stance towards the specific conditions of laissez-faire capitalism which produced the distinctive form of the city which they regarded as a universal 'natural order'" (Jackson 1985). And by the 1970s, "urban anthropology" was taking shape as its own subfield and was criticized for under-theorizing the notion of urban (Sanjek 1990), while being characterized as a "reformer's science" primarily focused on applying ethnographic methods to the study of "urban problems" (Hannerz 1980).

A reflexive trend in ethnography meant that over time the identity and privileges of researchers conducting urban ethnographies became a critical point of discussion. Many of the graduate students and faculty associated with the Chicago school were white middle class men who were studying poor communities of color. While I conceptually understood that my identity as a researcher would be a point of self-reflection, the process of spending time in Detroit made this a visceral experience. Encountering widespread poverty made me reflect upon my own privileges as a visiting researcher. This was followed by the realization that I was part of a steady stream of

visiting researchers coming to Detroit.

During my time in Detroit I repeatedly encountered people like myself – visiting academic researchers and documentarians and designers of various stripes. Nearly all of them claimed some kind of relationship or concern for "the community" while taking advantage of the situation in their own unique way. They tended to be formally educated, white, affluent enough to travel, and privileged enough to have a sense of ownership over their work. They tended to come from other major cities, either from the coastal United States or from Europe. I am admittedly part of this cohort. And if the Chicago school of urban sociology is any indication, this dynamic predates my time in Detroit. For community organizers and activists who call Detroit home, the steady stream of researchers is both an opportunity and a cost. This was foregrounded when I encountered skepticism and push back from a local activist who questioned my intentions. After meeting with several organizations involved with community networking in Detroit I received an email from one of the organizers who had been a central figure in writing grants and crafting the public narrative of their project. The email subject line read, "what are you doing in Detroit?" And in the email they asked "are you here to appropriate our work" and "steal our ideas?" The email communicated a desire to control the story of community networking in Detroit. It was also one of the few times I was explicitly challenged about what I was doing in Detroit. This pushed me to reflect on my own identity as a visiting researcher and rethink my agenda. I replied explaining that I was not interested in stealing their ideas but, rather, I was interested in understanding the situation and what it meant for the internet to be so central to the political economy and social life of the city.

3.3 Detroit as Allegory: Rise, Decline, and Reinvention

In this section I will continue to introduce Detroit as a site of study, by describing the social history of Detroit. This history is organized around a master-narrative involving Detroit's industrial rise, economic decline, and the hope of reinvention. The literature I discuss was directly informed by my fieldwork. I am less concerned with the macro causal explanations for Detroit's industrial rise and decline. Instead I focus on how conflict and power-relations evolved over time, and the stories and ideas that were used to explain their cultural and political significance.

The Rise of an Industrial City

The area known as Detroit is located along the southern basin of the Great Lakes. Combined, the Great Lakes make up the largest body of freshwater in the world and include a complex watershed and micro-weather patterns that support rich biodiversity and agricultural practices. The Detroit River is 24 miles long, connecting Lake Erie and Lake St. Claire, and acting as the international border between the United States and Canada. It is estimated that humans have lived along the Detroit River for over 11,000 years. In 1701 the French government established the *Fort Pontchartrain du Détroit* or Fort Detroit. The 17th and 18th centuries were marked by periods of violent conflict between French and British colonial forces and the indigenous Huron, Odawa, Potawatomi, and Iroquois people. By 1760 Fort Detroit was under British control, and subsequently became part of the U.S. Michigan territory. Lake Erie and the Detroit River became a transportation corridor for settlers heading westward. The burgeoning city became a port for shipping lumber and other natural resources to the East Coast. Like most major cities, the waterways and watershed defined the environmental conditions and design decisions of initial

settlements. The decisions made during the early settlement of Detroit informed long-term urban patterns that persist to this day. By the early twentieth century, Detroit experienced explosive industrial growth, with trains and then automobiles becoming the dominate means of exporting goods. With the 1908 release of the Model-T and the 1915 five-dollar wage, Henry Ford established Detroit and the Ford Motor Company as the symbolic and economic center of American industry. Antonio Gramsci describe "Fordism" as a distinct American ideology (Gramsci, 2000).

Fordism positioned the firm at the center of the economic and moral life of the city. With the use of standardized components, assembly lines, and relative high wages, the Ford Motor Company mass produced products that their workers could afford to purchase themselves. Standardization and the rational management of assembly line labor became an applied area of research known as Taylorism or scientific management. Taylorism was famously parodied in Charlie Chaplin's 1936 film *Modern Times*, which depicts Charlie Chaplin's signature character, the Tramp, frantically trying to keep up with an assembly line while being surveilled by a boss appearing on a large video screen. In another satirical scene Charlie Chaplin's character is the human subject for a prototype study of automated eating. While Taylorist practices were criticized for their dehumanizing qualities, they nevertheless contributed to productive gains experienced at the time. Labor economists and theorists on the left took great interest in Fordism and Taylorist methods and their relationship to labor theories of value.

In contrast with a classic Marxist focus on industrial production and labor value, Antonio Gramsci was interested in cultural differences between the U.S. and Europe, namely the contrast

between the European aristocracy and Henry Ford. Ford was obsessed with work and meritocratic ideals. According to Gramsci, Ford's work ethic was at odds with the culture of leisure associated with the European aristocracy. The distinction in cultural values between work and leisure formed the basis of Gramsci's view of Fordism as a distinct American ideology. Citing examples of worker surveillance outside of work, Gramsci argued that Fordism was just as much about the moral character of the worker and cultural practices that extended into daily life as it was about their productive labor. The notion of moral character that Gramsci describes is of course intertwined with Henry Ford's own ideological views. An outspoken anti-Semite and Nazi sympathizer (Sugrue, 2014), Ford was part of an elite that effectively owned and ran the Detroit metro area, pioneering welfare capitalism, where leaders of industry perform a paternalistic function of overseeing the rightful distribution of resources.

As one might expect, Ford was against labor unions. In 1935 the United Auto Workers, or UAW, was organized with assembly line workers at General Motors. Through a series of strikes the UAW rapidly grew in membership and power. The Ford Motor Company's resistance to the UAW culminated in a violent conflict that became known as the "The Battle of the Overpass," involving UAW organizers and Ford security personnel. By 1941, however, the Ford Motor Company agreed to collective bargaining. During this period of explicit conflict, the UAW was white only. The Ford Motor Company and other auto manufacturers hired African Americans as an anti-union strategy. With help from the National Negro Congress, the UAW began hiring African American organizers and slowly introduced African American workers into the union (Sugrue, 2014). Despite union membership, African American workers were often excluded from full benefits and given the most dangerous jobs and the least amount of pay. African

Americans experienced discrimination and exclusionary practices across both the labor and housing markets. Housing discrimination meant that African American workers were disproportionately barred from home ownership and, therefore, systematically excluded from the economic gains that came with the labor movement and federally subsidized mortgages (Georgakas and Surkin 1998).

Divisions within the UAW were not limited to race. Prior to the 1950s, leadership in the UAW was explicitly tied to the Communist party. By the end of the 1950s, the union had made the political calculation to purge itself of communist leadership. By the early 1960s in Detroit, the Black Power movement openly aligned with the Communist party. The League of Revolutionary Black Workers, a Detroit-based Leninist Black Power group, organized both within and outside of the UAW. They agitated on the shop floor against UAW orders and produced a series of publications distributed to African American communities. The *Inner City Voice* (ICV) had the masthead "Detroit's Black Community Newspaper" and "the Voice of the Revolution." The paper reported on local grievances and offered analysis of how these grievances were tied to white supremacy and capitalist power dynamics. The ICV's editor, John Watson, saw the paper as a vehicle for presenting an ideological analysis of capitalism in a popular style that foregrounded practice and action. "The unifying ingredient in all ICV material was the sharp emphasis on defining the strategy and tactics of the ongoing black liberation struggle and how it might prefigure and trigger a second American revolution" (Georgakas and Surkin, 1998; page 16). Systematically harassed by the FBI and the UAW, ICV editors were forced for find a new print shop for every volume they produced.

25¢

SAUTI THE INNER-CITY VOICE

The voice of Detroit's Black revolution

VOLUME 2 · NUMBER 2 DETROIT, MICHIGAN NOVEMBER 1969

FIGHT U.A.W. RACISM

BLACK WORKERS AT DODGE MAIN REJECT BACK TO WORK PLEAS BY SELLOUT U.A.W. OFFICIALS

Inner city Voice (ICV), issue from 1969

Detroit's decline was decades in the making

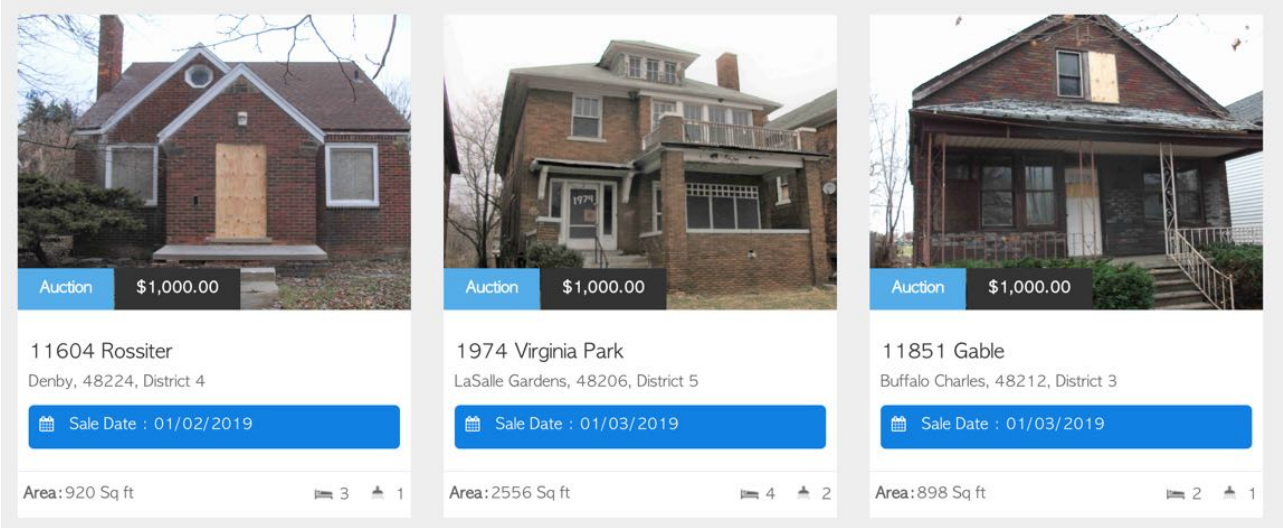
By the mid-twentieth-century, Detroit was the 4th largest city in the United States and widely regarded as a center of industrial innovation and economic opportunity for working people. During Detroit's population peak in 1950, the city was home to 1.7 million people, nearly a million of which were unionized industrial workers. During this period Detroit was a white majority city, with African Americans making up roughly 16% of the city's population (Smith and Kirkpatrick 2015). As I described in the previous paragraphs, racial segregation in labor and housing markets meant most African Americans were excluded from the economic gains that characterized the upward mobility of white Americans in the post-war era (Sugrue, 2014). Following its population peak in 1950, Detroit would become a textbook example of "white flight," losing over 60% of the city's population (Sugrue, 2014). Sugrue describes how the auto industries' withdrawal of manufacturing from Detroit, coupled with white flight and the unintended consequences of the 1968 Fair Housing Act, accelerated the economic and political abandonment of the city (Sugrue, 1996). This latter point about the unintended consequences of the fair housing act is worth further explanation. Prior to the Fair Housing Act, affluent African Americans were excluded from desirable neighborhoods, which meant African American neighborhoods had a mix of economic classes. Once enacted, not only did whites leave Detroit for nearby suburbs, so too did affluent blacks, further concentrating poverty in Detroit. In writing the twentieth century history of Detroit, what Sugrue makes abundantly clear is that many of the urban problems that have often been explained with cultural arguments are in fact byproducts of distinct policies and practices aimed at reinforcing racial hierarchies.

From the early 1970s onward, auto manufacturers began closing factories and relocating their production to take advantage of cheaper international labor markets (J. Boggs and Ward 2011). Leadership in the unions had become relatively docile and closely tied to corporate leadership. While the first half of the twentieth century marked the rise of unions, the second half was characterized by a decline in membership and a series of high profile failed strikes. International trade agreements enabled the closure and relocation of industrial facilities with little concern for the people left behind. The rise of networked computing, contingent labor practices, and regressive economic policies, including the slashing of urban housing funding, contributed to the financialization of the U.S. economy and the economic gutting of Detroit. At the city level, declining tax revenue meant that the Detroit municipality was chronically short on funding, leading to the closure and privatization of services throughout the city. Crack Cocaine and heroin flooded into the city, destroying lives through addiction, violence, and incarceration. The physical and political abandonment of the city left entire neighborhoods and industrial facilities to rot in a state of disrepair. The struggles of exploitation became the struggles of chronic unemployment. Decades of population loss and economic decline also came with a shift in the city's racial demographics; by 2015 African Americans made up roughly 85% of the city's population ("U.S. Census Bureau", 2015). With an estimated population of six hundred thousand people (in 2015), roughly half were living in poverty, and roughly 40% were considered functionally illiterate, meaning they lacked the necessary reading and writing skills needed for many jobs (National Institute for Literacy 2013).

With the great recession of 2008, Detroit's already depressed property market experienced an accelerated collapse with widespread mortgage and tax foreclosures, abandonment of homes, looting, and arson (Smith & Kirkpatrick, 2015). The collapse of the property market also involved the decline of ancillary urban systems and infrastructures. For instance, in the decade prior to my fieldwork, most of the streetlights had gone missing; they were either repossessed by the companies that installed them or looted for copper wires (Smith & Kirkpatrick, 2015). The water and gas mains were also outdated and regularly broke, flooding streets and leaving neighborhoods without basic utilities for weeks at a time. The urbanist Brent Ryan made a career out of studying shrinking cities, including Detroit. In his book *Design After Decline,* Ryan argues that Detroit's decline is emblematic of a larger national decline in urban policy and a loss of faith in government. This loss of faith in government was a theme I repeatedly encountered in my interviews with activists and community leaders in Detroit. The depopulated areas of Detroit foreground the fact that, when regional and local markets collapse, local municipalities have a limited capacity and window of time to mitigate a series of cascading problems. In the context of Detroit a loss of faith in government and bad government became a self-fulfilling prophecy.

Ryan argues that municipalities of shrinking cities like Detroit have an obligation to develop tactics to improve the quality of life for residents living in areas where economic recovery is not likely to occur. Ryan calls this idea "palliative planning" or "palliative design" (Ryan 2014). In practice, Ryan's notion of palliative planning is embodied in the Detroit Public Library, an increasingly multifaceted public institution and one of the few public services that remain open throughout the depopulated areas of the city. Having said that, the largest intervention by local and regional government has been focused on managing abandoned properties. With the goal of

stabilizing Detroit's real-estate market, the county and city governments organized two parallel efforts, the Land Bank, which auctions abandoned properties, and a campaign to demolish abandoned properties that are considered unsalvageable. Both of these efforts are well known tactics used across other shrinking cities.



screenshot of https://buildingdetroit.org, 2018

The Detroit Land Bank Authority was created with the mission of "disposing of vacant, blighted and abandoned property in order to return them to productive use" ("Detroit Land Bank Authority" 2018). While the land bank auctioning system was well publicized and designed to streamline online purchases with a starting bid of $1000, the systems for helping people avoid foreclosure had little publicity and were cumbersome and not well documented or understood. While online auctions enabled much needed investment, for every well-intended remodeler and urban homesteader, the online auctions enabled a streamlined cottage industry of turn-key slumlords. The other major effort by the municipality was the demolition campaign, which started in 2014. By the time I arrived in Detroit, the city had spent 90 million dollars on demolition contracts, demolishing 13,000 buildings, with the long-term goal of demolishing a

total of 40,000 structures (City of Detroit, 2017). The demolition, coupled with arson, produced large swaths of open land, areas that feel surprisingly rural despite technically being in the city.

example of "ruin porn" directly across the street from new housing, 2017

Competing visions of a future Detroit

Detroit's most visible expressions of urban blight and deindustrialization have been well documented by photographers. Many Detroit residents begrudgingly refer to this work as "blight porn" or "ruin porn" (Doucet and Philp 2016). The photographer and author John Patrick Leary describes ruin porn as a genre that "aestheticizes poverty without inquiring of its origins" (Leary 2011). The ruin porn genre contributes to the myth that Detroit's decline is exceptional rather than understanding it as an extreme example of something that is occurring throughout the deindustrialized rustbelt. For many Detroit residents the ruin porn genre provides a one-sided view of the city. Photo essays of Detroit ruins rarely show the well-maintained buildings and ongoing enterprises that are down the street from abandoned buildings and industrial ruins.

As I discuss in chapter four, Fordism was an ideological project that put the firm at the center of the economic and moral life of the city. The closing of factories and economic consequences of deindustrialization marked a profound shift in the cultural identities of communities in Detroit. Radical activists were no exception. In fact, many of the activists involved with the Black Power Leninist movement were auto factory workers themselves. With factories closed, industrial labor was no longer a staging ground for revolutionary organizing. New tactics and social imaginaries were needed. No other figure better speaks to this transition then the lifelong activist, scholar, and educator Grace Lee Boggs. A Chinese-American woman, Boggs earned her doctorate in philosophy from Bryn Mawr College in 1940. Facing barriers to a traditional academic career, she became involved in the Leninist Black power movement as an organizer and writer. She moved to Detroit in the early 1950s to be with her husband, who was an industrial auto-worker, activist, and writer. Together they regularly contributed to the *Inner City Voice* and wrote numerous books calling for a second American revolution. Through this work Boggs became a central figure in Detroit's activist milieu until her death at 100. Witnessing the devastation of deindustrialization firsthand, Boggs gave voice to an anti-authoritarian leftist perspective that was more interested in developing models of sustainable cooperative living and caregiving than in seizing power. Towards the end of her life, Boggs wrote:

> *"Instead of trying to resurrect or reform a system whose endless pursuit of economic growth has created a nation of material abundance and spiritual poverty… we need to build a new kind of economy from the ground up. This is what I have learned from fifty-five years of living and struggling in Detroit, the city that was once the national and international symbol of the miracle of industrialization and is now the national and international symbol of the devastation of deindustrialization." (G. L. Boggs and Kurashige 2012)*

Boggs described the economic decline of Detroit as an opportunity for reinvention. For Boggs this space for hope and reinvention was found in her work as an educator and public intellectual. Following her involvement with the black power movement of the 1950s and 1960s, Boggs stayed in Detroit and worked as an organizer and educator, running an inter-generational school for local activists that was focused on building community autonomy and anti-authoritarian ideals. A collectivist, Boggs framed her writing not so much as her own, but as a critical articulation of ideas present within her community of fellow activists. In chapter 4, I discuss how Boggs influenced the activists involved in building wireless community networks. Many of the communitarian ideals Boggs wrote about directly influenced how local activists involved in community networking described their efforts to create decentralized ownership and control of digital networks.

Boggs was not alone in seeing Detroit's decline an as opportunity; numerous scholars, journalists, and designers have made similar arguments. In *Reinventing Detroit,* L. Owen Kirkpatrick and Michael Smith assembled a diverse set of authors who reflect on the many crises involved in Detroit's decline and the possibility of the city giving birth to a new communitarian political economy. Kirkpatrick and Smith argue that the economic sociologist Karl Polanyi's work offers a useful analytic framework for parsing the trends of urban homesteading and other bottom-up forms of community action found in Detroit. They build upon Polanyi's notion of the "double movement" between marketization and community self-protection, arguing that Detroit's legacy of institutionalized racism created a "*racial segmentation of the double movement*" (Smith and Kirkpatrick 2015). Gar Alperowitz and Steve Dubb argue that local leaders should focus on "community wealth building, an asset-based strategy that builds upon

existing local talents, capacities, facilities, capital, and expenditure flows to develop locally owned—and often community owned---anchored businesses that can help sustain the local economy." (Alperowitz & Dubb, 2015) As a counter point to market driven economic development, the notion of "anchor" institutions and businesses became a popular concept in progressive community development circles by the early and mid-2000s. Anchor institutions, such as hospitals and public libraries, are in theory committed to their community and place far more than investment capital. In chapter 5, I describe how building regional broadband networks of anchor institutions became policy priority for the Federal Communications Commissions under the Obama administration, which contributed to the building of the Detroit public library's internet service provider – Merit Network, a non-profit statewide network focused on serving public sector and educational institutions.

Towards the end of Boggs' life, capital was beginning to return to Detroit, specifically downtown Detroit. Out of Detroit's 142-square-miles, the 7.2-square-miles of downtown, underwent a rapid transformation (Runyan 2017). In 2013, the billionaire Dan Gilbert moved his company Quicken Loans from Livonia, Michigan to downtown Detroit, bringing sixteen thousand white collar employees downtown. Gilbert's investment company Rocket Ventures redeveloped the downtown area, financing the installation of new streetlights, public landscaping, a network of 500+ security cameras, a private para-police force that patrols the downtown and midtown areas, a new trolley car system, and a high speed internet service provider (Wamsley 2017). Gilbert and his colleagues described their vision for the future of Detroit as a hub of "innovation" and "hi-tech" companies. In the process of redeveloping downtown, Dan Gilbert acquired over 70% of the buildings in downtown Detroit (Aguilar 2016).

In the context of Detroit there is a historic precedent for Gilbert's consolidation of power. In the early twentieth century, at the height of their power, "the big three" auto companies bankrolled and managed large municipal-like systems such a gas and water mains that serviced both residential and commercial properties (Sugrue 2014). The auto companies had deep cash reserves that funded the municipality, affording them almost dictatorial control over matters concerning their interests (Georgakas and Surkin 1998). In this regard there are strong commonalities, with the tendency towards corporate plutocratic governance. But the differences should not be overlooked. While the auto companies had immense control, it was also a period of strong unions and public investment. By contrast, the decades preceding Quicken Loan's arrival were characterized by prolonged financial crisis, political abandonment, and the closure and privatization of public services. In this regard, Detroit is an allegory for the larger U.S. political economy, one that involves several interlocking stories, including the history of deindustrialization, the busting of unions, the permutations in corporate power from industrial production to hi-tech financial services, and the story of racialized economic inequality and the widespread loss of faith in government. But it is also important to note that Detroit is a story of hope, resilience, and reinvention.

Thus far I have described a history of Detroit that is largely focused on the twentieth century and discussed Detroit's industrial rise, decline, and more recent attempts to reimagine the future. Gilbert's investment in downtown has radically changed the city in a few short years. While the building of a high speed internet service provider is part of a larger campaign to redevelop downtown Detroit, it is important to stress how central network and computing infrastructure is

to this larger project. Not only is commerce increasingly reliant upon digital networks, political power and conflict are increasingly mediated and defined by the management of information systems and network infrastructures.

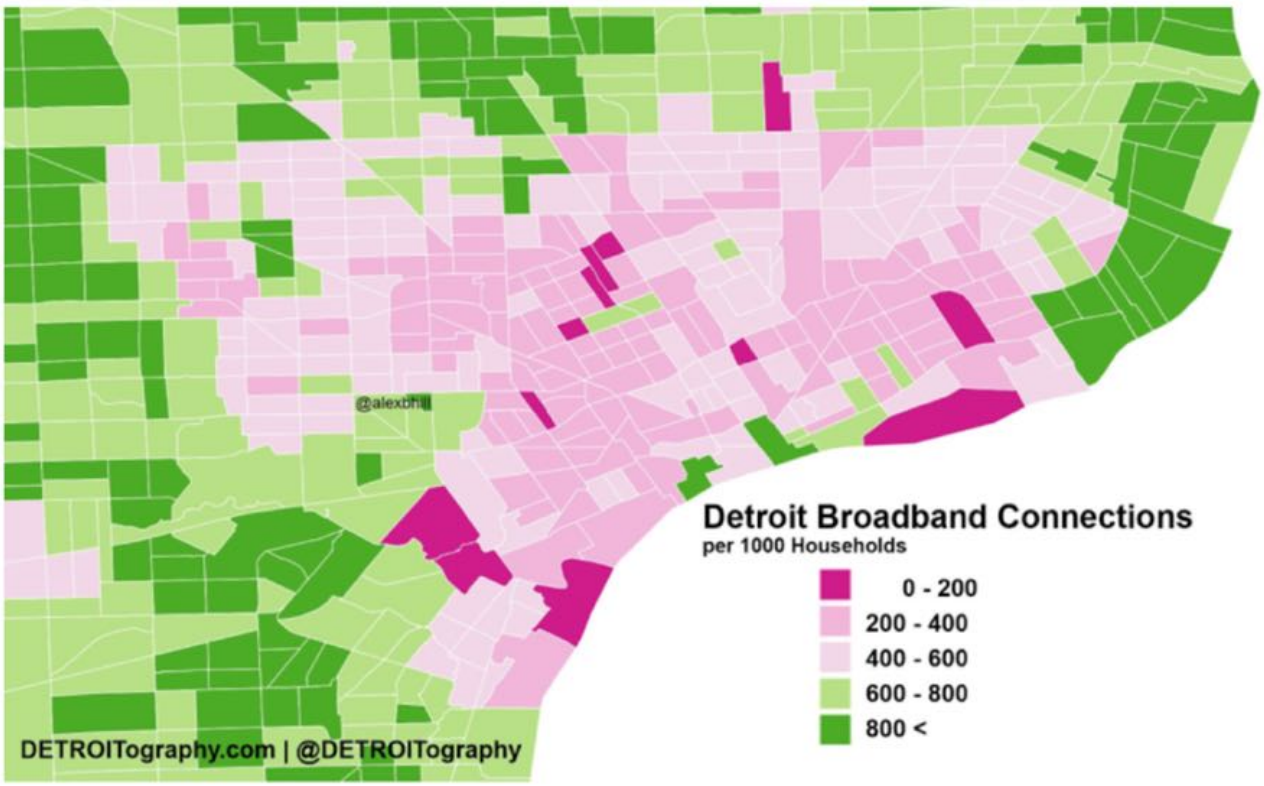
3.4 Internet access in Detroit

In the context of Detroit, low-income communities of color are often characterized by their perceived and real deficits. Detroit's low rate of residential internet access has been described as an example of the digital divide, and as a problem to be solved. The phrase "digital divide" came into use in the late 1990s to describe divisions found in the United States between those who had access to information technology and those who did not (Compaine 2001). As the concept gained currency among academic and policy researchers, digital divides were studied at various geographic scales, global, international, national, regional, and so on (Hilbert 2011). Within national and regional contexts, correlations have been identified between internet access and demographic factors, such as class, education, gender, race, and age. Closely aligned with issues of poverty and inequality, the internet is evoked as an infrastructure of economic development, even by those that are critical of the asymmetries of knowledge and power that have come with digital surveillance. Within the classic digital divide equation of haves and have-nots, internet is often frames as a singular homogeneous resource. This perspective flattens over the different institutional priorities and technical configurations that are often involved in supporting internet access. In this section I discuss the institutional history of the three main internet service providers operating in Detroit, the sites of "free WiFi" they enable, and recent demographic survey research regarding internet access. All of this has direct relevance to the subsequent case study chapters.

In 2016 it was estimated that 40% of Detroit households did *not* have residential internet access ("Internet Connection Data for Cities" 2017). Journalists have argued that the low rate of residential internet access is a byproduct of two factors: limited coverage from the internet service providers and the relative high cost of internet access for those living in poverty (Bach 2017). More largely, Pew Research's longitudinal survey on residential internet access and use, from 2000-2018, compiled national demographic data on residential broadband access. While income and race had strong correlations with residential internet access, the number one indicator was education. According to the Pew study, those *without* a high school diploma are half as likely to have residential internet access as those who finished high school, and one third as likely as those who graduated college ("Demographics of Internet and Home Broadband Usage in the United States | Pew Research Center" 2017). According to 2015 census data, 20% of Detroit residents did not finished high school, 32% completed high school but never went to college, and another 33% attended some college but never graduated ("Detroit, MI - Census Reporter" 2017). When examining these indicators at the neighborhood level, there are stark divisions between downtown Detroit and most of the city. In an interview I conducted with Detroit-based urban planner Edward Lynch, he explained, "the problem with maps of Detroit is that they all look the same. When mapping most economic or public health indicators a predictable pattern emerges, downtown is doing well while the rest of Detroit is still in decline."

Unsurprisingly, when looking at the geography of residential internet access one finds the same divisions Lynch described, with downtown Detroit having ubiquitous high speed internet connectivity while most of the city has fragmented internet coverage. It is also important to note how these socioeconomic divisions are present along the borderline between the city of Detroit and neighboring suburbs. As I discussed in previous section, the twentieth century history of

white flight involved a broader trend of suburban growth, with people leaving large cities to live in suburban towns. Unlike the water mains and gas lines that have had decades to corrode and fall apart, the telecommunications infrastructure is relatively new. Despite the federal government spending billions of dollars annually on telecommunication subsidies, there is no regulatory requirement for universal residential internet service. And in Detroit there has been little market incentive to improve coverage in depopulated areas of the city.



Map of broadband connections via detroitography.com, 2016

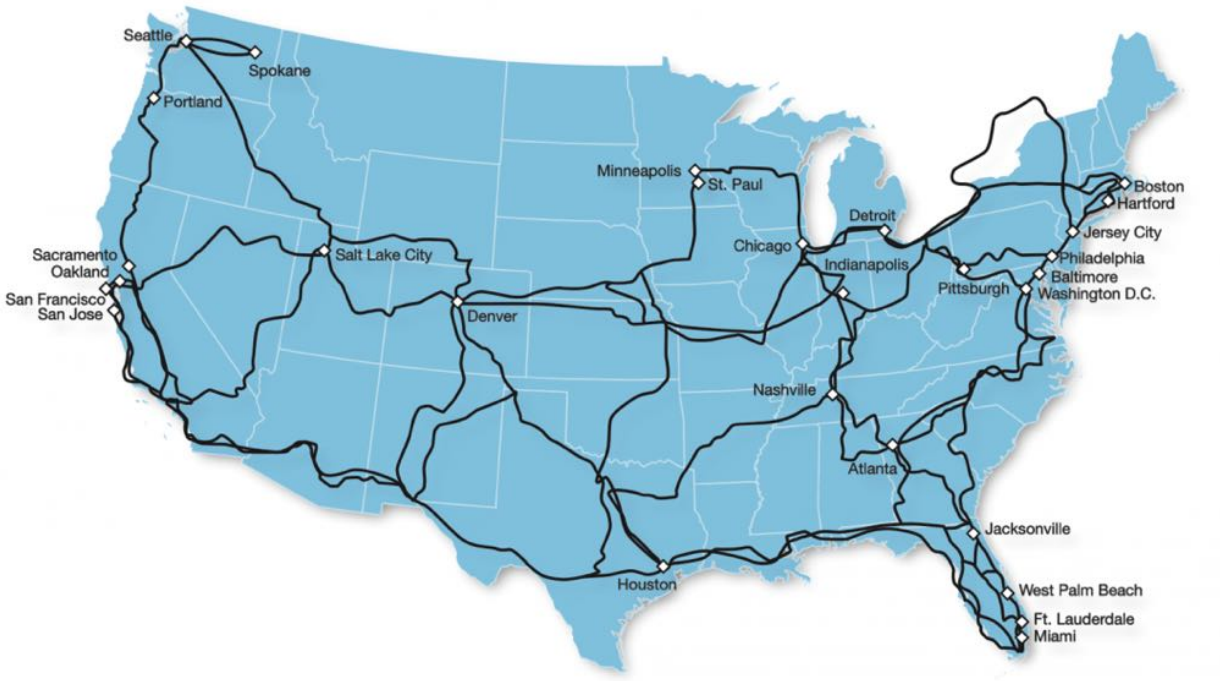
At the time of my fieldwork, like most U.S. cities Detroit did not have a municipal network. Instead there were three main internet service providers operating in Detroit: *Rocket Fiber*, *Merit*

Network, and *Comcast*. Rocket Fiber and Comcast were both commercial internet service providers; while Comcast operates at a national scale, Rocket Fiber was local to Detroit. In contrast, Merit Network is a non-profit statewide "research and education" network focused on serving public sector and educational institutions. What follows is a Detroit-centric history of these three internet service providers.

Comcast

Initially a cable company, Comcast began offering residential and commercial internet service in 1996, and Detroit was among the first markets it entered at the time (Richtel 2002). With no universal service mandate for residential internet and few market incentives, Comcast's coverage in Detroit (particularly in the depopulated areas of the city) was fragmented, leaving many homes and entire neighborhoods offline. Despite the limited coverage, Comcast remained the de facto monopoly internet service provider for most of Detroit. For low-income residents living within Comcast's coverage area, prepaid internet service enabled internet access to be a month-by-month question depending on other expenses. As the dominate internet service provider operating in Detroit, Comcast was also the main enabler of "Free Wi-Fi" offered by local laundromats, fast food restaurants, and even activist-built community networks. In chapter 4, I discuss how Comcast's fragmented coverage was one of the motivating factors for activists involved in building wireless community networks in Detroit. Wireless networking offered activists a low cost way to share internet in areas where Comcast's coverage was limited or where residents could not afford internet. This economic logic is not limited to community networks; at the edge of every network there are economic tussles over costs and service delivery. In chapters 5 and 6, I discuss how these same conditions of fragmented coverage and

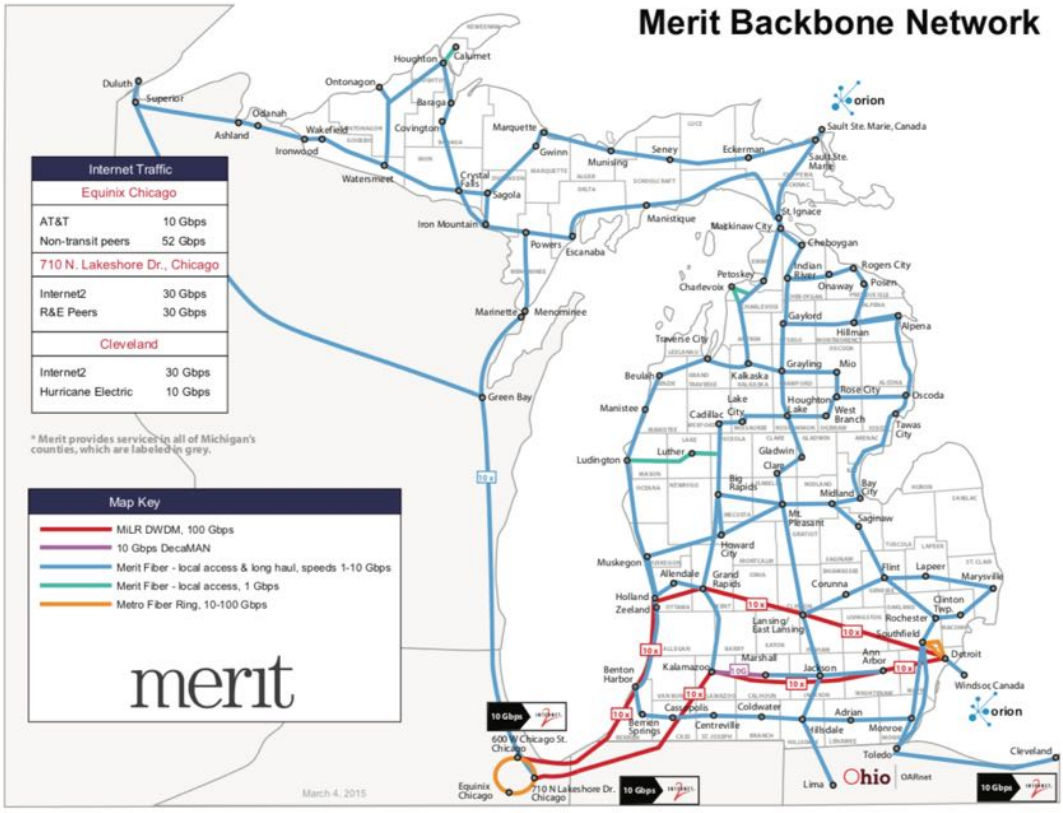
poverty made “Free Wi-Fi” at the public library and fast food restaurants an important resource for low-income communities often living without residential internet.



Map of Comcast’s nationwide fiber network, 2014

Comcast’s 2002 purchase of AT&T Broadband made it the largest cable provider in the United States. With over 25 million internet subscribers, Comcast continues to be one of the nation’s largest internet service providers (Brodkin 2014). As such, Comcast not only provides what is referred to as last mile service (meaning they connect individual homes and business to the internet), they also run a national backbone network (managing upstream network traffic from other internet service providers via internet exchange points) (Brodkin 2014). In this sense, the geographic scale and network centrality of an internet service provider can be used to measure their political and economic power relative to other service providers.

While firms like Comcast spent millions of dollars campaigning against the idea of municipal internet service providers, the United States has nevertheless built a quasi-public system of regional internet service providers that are referred to as "research and education networks" or "R&E Networks." Merit Network, which I discuss below, is one of the largest and most commercialized R&E networks in the United States.



Map of Merit Network's statewide fiber network, 2017

Merit Network

Founded and governed by Michigan's public research universities, Merit Network's history goes

back to early internet research in the 1960s. In the 1980s Merit managed the NSFNet ("Merit History" 2018). By the mid-2000s, Merit Network commercialized into a statewide backbone network providing service to public sector and educational institutions ("Merit Completes REACH-3MC Network Project | Merit" 2017). Since its commercial expansion, Merit Network has been the internet service provider for the Detroit public library's 23 branches that remain open throughout the city, playing an important role in providing internet access to low-income communities living in depopulated areas of the city. Operating on the state of Michigan's geographic scale, Merit Network has positioned itself as a leader in municipal networking, researching and deploying network security strategies that reflect the organizational structure and concerns of municipal governments and public services.

By serving the Detroit Public Library, the Merit Network receives funding from the Federal Communication Commission's universal service fund, E-rate program. The expansion of Merit Network as a service provider was a flagship example of the Obama-era FCC's vision of expanding R&E networks to create regional broadband networks of "anchor institutions," or organizations that are committed to serving their local communities. The economist and political scientist Charles Lindblom argues that the theoretical nature of ideal political economies has little relationship with the actual practice of public policy. According to Lindblom, economic modeling and analytic frameworks find their utility in the sub-optimization of narrow consideration, beyond which they lose their value. Lindblom was a champion of "incrementalism," famously describing it as process of "muddling through" (Lindblom 1959). While some conservative pundits have questioned the value of public libraries, the Obama-era FCC realized that they played a vital role in providing internet access for low-income

communities. The muddling through of these policies was less of a grand intervention and more of a tectonic nudge towards building internet service providers that are explicitly aligned with the mission of public service.

During my fieldwork in Detroit, I repeatedly found that the public library was one of the most important spaces for supporting internet access. These observations are supported by a body of research that is focused on internet access at public libraries. The U.S. Impact Study from 2010 found that internet access had become one of the most sought after public library services. According to the study, 45%, or 77 million of the 169 million people who use public libraries, used library computers or wireless network during their visit. Put in terms of total population, 32% of the national population used public libraries to get online. For those living below the federal poverty line the percentage jumped to 44%. As I discuss in chapter 5, the neighborhood branches of the Detroit Public Library located throughout depopulated areas of the city serve poor communities with low rates of residential internet access and high rates of illiteracy.

Rocket Fiber

In contrast with Merit and Comcast, Rocket Fiber operates exclusively in Detroit. Shortly after relocating the Quicken Loans' headquarters to downtown Detroit, billionaire Dan Gilbert, and his investment company Rocket Ventures, invested heavily in the redevelopment of downtown. This included the building of a new high speed internet service provider known as Rocket Fiber. Incorporated in 2014, Rocket Fiber was initially focused on renovating Gilbert-owned properties in downtown (Gross 2016). It was understood that high speed internet would be a prerequisite for attracting the large firms needed to make Detroit a "hi-tech" hub. But Rocket Fiber's coverage

area was initially limited to downtown Detroit, until the building of the "Qline" trolley car system.

left: Map of Rocket Fiber's 3.3 mile of Woodward Ave. middle: Qline test run 2017. right: Protesters May 2017

Another Gilbert-backed development project, the Qline ran along Woodward Avenue for 3.3 miles. As part of their expansion, Rocket Fiber built "Free Wi-Fi" hotspots along the Qline while also leveraging their network to run internal communication and security for the trolley car. By virtue of its placement, Qline design and Rocket Fiber network reinforced the centrality of Woodward avenue within the radial city grid that was designed by Augustus Woodward, after the 1805 fire that leveled the city. Critics of the Qline argued that money spent on the trolley car would have been better spent improving the bus system that serves the entire city. While well intended, what this argument fails to acknowledge is that the Qline was never designed to be a functional mass transit system, but rather a symbolic demarcation of space. The Qline clearly illustrates the boundary between the new Detroit that was being redeveloped and the rest of Detroit that was slowly being demolished. In this regard, the Qline and Rocket Fiber are part of a broader campaign to rebuild the Detroit property market, and part of longer history of

transportation and communication networks being used to transform land into property.

Kazys Varnelis argues that contemporary cities should be best understood as a series of codependent systems involving "environmental mitigation, land-use organization, communication and service delivery" (Varnelis 2008). Similar in language and tone to Srinivasan and Fish's argument that digital networks should be understood as "inseparable from peoples, places, laws, and environments" (Srinivasan & Fish, 2017; page 73), Varnelis theorizes the city as a "networked ecology," where network infrastructures, political pleasures, and economic and environmental constraints produce complex feedback dynamics.

The internet service providers operating in Detroit are embedded within numerous economic tussles. The foundational economic and political question is when and where to build network infrastructures. This foundational question is tied to the dynamic of transforming land into property. But once a network is built, the concern over cost resides at the edges of the network. On one end there is the customer and internet service provider relationship, a clear economic tussle regarding the cost of internet access. At the other end of the internet service provider's network are economic concerns regarding their relationship to internet exchange points, or IxP. Internet exchange points are where the network becomes an inter-net, with internet service providers exchanging network traffic with one another. As Paul Dourish points out, "[the] crucial feature of internet technology is that is provides a way for data to move between multiple networks, potentially of quite different sorts. What we call the internet is a collection of networks linked together … in such a way that data can move easily from one to another." (Dourish 2017, page 141) Within this arrangement, Dourish describes the three "triers" network service

providers, *tier 1* involving global networks, *tier 2* providers operating at the scale of nations, and *tier 3* networks operating at the scale of regions or cities. Traditionally internet service providers metered network traffic to calculate an exchange fee that they would pay one another, but over time many exchange points and *tier 1* internet service providers established "peering" policies that enabled service providers to exchange data without charging one another. Dourish argues that peering policies reinforce the centrality and power of tier 1 providers, and that these institutional relationships were not designed or planned, but rather emerged through the processes of building networks. "This arrangement is not the consequence of the network's design, as such, but it is a consequence of the historical processes of bringing the network into existence…" (Dourish 2017, page 160). Similar to the customer-service providers relationship, the internet exchange points represent a point of economic tussle.

Many of these same issues regarding the cost of service delivery, that often reside at the edge of the network, have been motivating factors in building both local area wireless networks. Compared with the costs of building fiber networks, wireless standards offered communities the ability to build low cost networks that could connect to commercial internet service providers or directly to an internet exchange point. In many cases, those building wireless community networks have been motivated by emancipatory ideals of decentralized ownership, control, and privacy. By contrast, the commercial proliferation of "Free WiFi" has made surveillance a routine product feature for both marketing and security purposes. In the next section, I discuss the history of wireless community networking and the intertwined development of commercial proprietary systems, while drawing connections with the cases I present from Detroit.

3.5 The Economic Logic and Emancipatory Ideals of Wireless Networking

This dynamic of projecting emancipatory ideals onto the internet and digital technologies is exemplified by the wireless community networking movement, which looked to low cost wireless tools to create cooperatively managed distributed networks. The recent history of wireless community networking is particularly relevant for the activist-built wireless network that I discuss in chapter four. But the relevance of this history is not limited to the activist case study. Many of the key people and technical problems that were at the center of community networking were also tied to the development of commercial services.

By the early 2000s the 802.11 family of Wi-Fi standards helped produce low cost, easy to use, and easy to modify technologies. In the U.S. self-described "wireless cowboys," or small commercial internet service providers, began using 802.11 standards to build low-cost wireless networks to provide internet access to rural communities (Flickenger 2002). With a 15-inch parabolic dish producing a range of ten to twenty miles and a three foot antenna reaching 50 miles or further, wireless became the strategy of choice for small, rural operations. During this same period the "free" or "community" wireless networking movement began to take shape in the U.S. and across European cities. Schmidt and Townsend (2003) describe the "free wireless movement" of the early 2000s as split into three overlapping areas: the educators, the philanthropists, and the networkers. The educators were made up of Bay Area radio and wireless user groups and their Burning Man offshoot, PlayaNET, and were primarily focused on educational outreach. The philanthropists were busy building free Wi-Fi hotspots in public spaces and cafes in U.S. and throughout European cities. The philanthropists' hotspots provided quasi-public internet access through existing internet service providers, and foreshadowed the

now common practice of "free Wi-Fi." The "networkers" were those frustrated enough with the telecommunication companies to start building their own wireless networks (Schmidt and Townsend 2003). In this regard many of the communities involved in the "free" wireless milieu that Schmidt and Townsend describe were embedded within economic tussles similar to those discussed in the previous section. The Guifi network is one of the largest wireless community networks, with over 33,000 active nodes and 46,000 Kilometers of wireless links across the Catalonia region of Spain ("Guifi.Net" 2018).

By the mid-2000s, wireless community networking was spreading throughout the global south. This was, in part, enabled by the South African group Village Telco, which worked with German-based community networking developers (from the Freifunk network) to design and test a wireless toolkit specifically designed for rural agrarian villages with little to no electricity and no existing telecommunication infrastructure. The book *Wireless Networking in the Developing World* was written by an international team of collaborators as a way of sharing tactics and empirical case studies. Covering a wide range of material, from the basics of radio frequencies to the identification of economic incentives, the book argues for a culturally and economically responsive approach to designing wireless networks in diverse communities (Flickenger 2007). One example of a culturally responsive project would be the "Meshpotato" developed by Village Telco. Working with rural South African communities with low levels of literacy, voice communication was preferred over text. The Meshpotato was designed to connect analog landline telephones using a wireless voice over IP network. Initially implemented in rural areas with no electricity, each phone and Meshpotato included a small solar panel ("Village Telco" 2018). While European groups like the Freifunk and Guifi relied on informal reciprocity between

participants, the communities that Village Telco was working with required a different approach. When building wireless networks in rural agrarian communities, clear economic incentives or reasons for using the network were needed, along with sustainable business models to keep the network running. To this end, Village Telco developed networking tools for billing and metering network traffic to support local entrepreneurs maintaining and building networks. Whether one was motivated by emancipatory ideals or notions of economic development, proponents of wireless networks often found themselves educating the public about the significance of wireless broadband. Making arguments that were both economic and political in nature, they argued that wireless broadband would facilitate economic development while promoting social equity and democracy.

examples of "cantenna" circa 2002

The early growth in wireless networking in the early to mid-2000s can be tied, in part, to the work of Rob Flickenger. In July of 2001, Rob Flickenger used an empty Pringles can to create a directional antenna and wireless connection between his home and office. Flickenger documented his Wi-Fi experiment and published it online. A modest swell of interest followed, and the design became known as the "cantenna" (Flickenger, 2002). As an activity, building cantennas helped bridge the worlds of pirate radio and wireless networking. In her ethnography, *Low-Power to the People,* Christina Dunbar-Hester describes how activists involved in building community radio stations began building wireless data networks. Quoting an interview from her fieldwork, Dunbar-Hester highlights the educational value of the cantenna.

> *"The cantennas [are] an organizing tactic. It's an easy piece of technology to build. It's a useful piece of technology. In the ten or twenty minutes it takes someone to learn to use a cantenna, you learn RF [radio frequencies], you learn DIY sharing of a public resource, like public airwaves stuff, you handle a drill, you handle a soldering iron, you have them handle a component, you learn about cabling, it's a fucking barnraising in a ten-minute package; it's the best tool for that." (Dunbar-Hester 2014)*

Dunbar-Hester describes radio frequencies as the material bridge between radio and Wi-Fi activists. The "barnraising" function of the cantenna effectively weaves together the activists' technical and political mission of "raising awareness about citizen use and ownership of the spectrum" (Dunbar-Hester, 2014 page 170). Radio and community wireless activists shared a common belief that local community-controlled communication systems had the democratic potential of creating a public space for exchanging ideas and stories. Examining the discourse of wireless community network organizers, Alison Powell argues that metaphors such as "commons, sidewalks, public utilities, parks," and "third spaces," frame local wireless networks as "democratic communication spaces" (Powell 2011). But the metaphors of "sidewalks" and

"parks" that Powell describes are not only metaphors. Wireless networks represent tangible interventions into the built environment, often in parks and across sidewalks (Torrens 2008).

In his book *Building Wireless Community Networks,* Flickenger describes an environmental awareness that emerges as one builds wireless networks. "…You'll find yourself looking at your environment in a different way. Air condition ducts, pipes, microwave ovens, power lines, and other sources of nastiness start leaping into the foreground as you walk around" (Flickenger, 2002). In a similar vein, a white paper from the Wireless Internet Service Providers Association describes local service providers as "carefully shaping their coverage patterns" across rural landscapes (Interisle Consulting Group 2015). In the early 2000s, implementing a multi-hop wireless network that could extend the coverage area of a wireless signal involved detailed planning and coordination of nodes. The labor intensive quality of building and maintaining multi-hope wireless networks, particularly in urban areas, meant most large commercial internet service providers avoided it altogether.

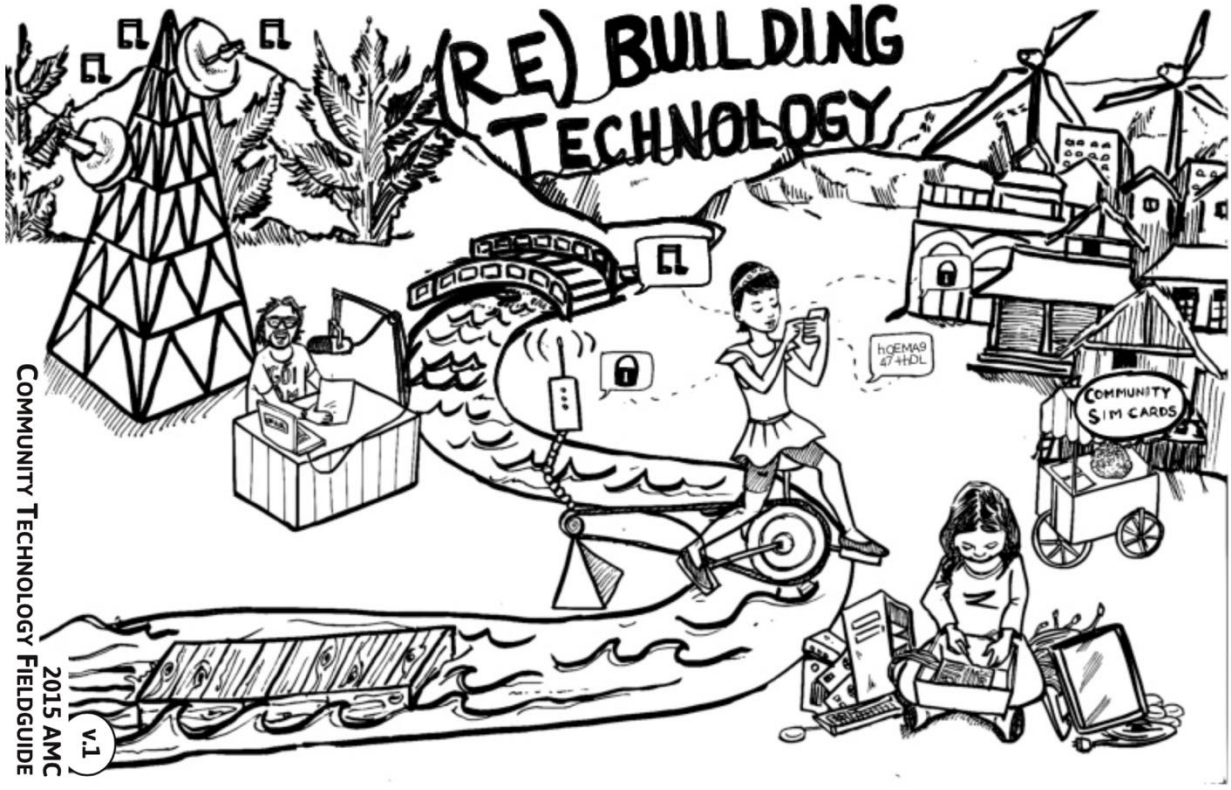
During this time, an open source research project called "Roofnet" (Chambers 2002; Bicket et al. 2005), that was loosely affiliated with the community networking movement, developed new wireless routing techniques and self-configuring nodes, that made installing and maintaining multi-hope wireless networks much easier (Aguayo et al. 2003). In 2006, with venture capital from Google, the Roofnet team incorporated as Meraki and began developing their proprietary cloud-based wireless toolkit that was designed to streamline the installation and maintenance performed by local network administrators. While Meraki's choice to go with a cloud-based design was met with criticism by some, their product nevertheless proved to be popular among

network administrators. Whether one was building a WiFi network at thousands of fast food restaurants or a public library system (as I discuss in chapter 5 and 6), the Meraki "dashboard" offered clients a centralized point of control for creating custom information policies that could be applied to all of their networks. But it also meant that Meraki clients were indefinitely tied to the Meraki cloud as a third party intermediary.

By the late 2000s Meraki began to dominate the WiFi market. With their cloud-based approach, their next critical insight was that they could leverage their network's data collection capacities to develop a suite of services that would cater to a wider range of needs, including marketing and security. This corresponded with a growing body of research focused on WiFi as an instrument for collecting behavioral data (Kjærgaard and Nurmi 2012); and the various applications for which data collection can be used, such as a "real-time" census of Manhattan (Kontokosta and Johnson 2017), the analysis of customer behavior in retail spaces (Hwang and Jang 2017), and social interaction analysis through the measurement of physical proximity of devices (Sapiezynski et al. 2017). Thus, data collection and analysis become a notable aspect of the Meraki platform.

Like most major cities in the United States, Meraki had a notable presence. It was featured in two of the three cases I present in the dissertation, including the Detroit Public Library's WiFi network and Burger King's "Whopper WiFi." By contrast the community built wireless network I discuss in chapter four, used a bespoke open source wireless system that was designed with the expressed purpose of protecting user privacy, through the use of end-to-end encryption and locally hosted applications. Very much aligned with the Boggs' school of activism, in a self-

published zine, Detroit-based technology activists describe their work as resisting dominant systems of control.



cover art from rebuilding technology v1 zine, 2015

In the *(Re)Building Technology v1* zine*,* Detroit-based technology activists describe a hegemony of government and corporate surveillance, with "community-based technology" projects serving as a form of resistance, offering an alternative model for how communities might relate to digital technology and the internet (Gerety, Gunn, and Nucera, 2015). In an emancipatory vein that also aligns with economic development, the zine argues that the internet can "transform our communities, assist in economic development, and help residents understand and utilize the

power they already have." The zine goes on to outline a notion of "digital justice" that not only involved the distribution of resources, in this case internet access, but also the cultivation of a critical technological consciousness through informal community education.

While the *(Re)Building Technology* zines outline a clear ideological distinctions regarding the use of technology, in practice the situation is more complicated. While Meraki and other commercial WiFi systems could be characterized as a data collecting boogieman, they nevertheless play an important role in providing consistent and predictable internet access for communities where residential internet or mobile data plans are in short supply. Furthermore, the information policies clients establish for their Meraki networks depends on their institutional priorities, while Burger King leverages the data collection capacities of Meraki to maximize profits the Detroit public library's director of information technology explained that they never look at the data that's being collected. While the distinctions in values is somewhat pronounced when examining the design and configuration choices of network administrators and system designers, once one examines the concerns of "end-users" from the community that regularly move between these networks, the dynamic is far more fluid. For young adults that rely upon "Free WiFi" to get online, the practical desire to access to online content and message their friends and family trumps concerns for digital privacy.

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Chapter 4: Community Networks

In this chapter I describe an ethnographic vignette from my fieldwork in the North End neighborhood of Detroit. The ethnography centers around the North End WiFi Network, a local area wireless community network. I discuss the emancipatory ideals, motivations, and aspirations that activists project onto the internet. One of the central findings from my observations was how grassroots activists craft narratives that repackage longstanding tropes of the deserving poor and notions of self-reliance. Such narratives often circulate online, and their primary purpose is to gain access to resources. I describe this dynamic as *narrative capitalism* and argue that it is partially a byproduct of a loss of faith in the government's capacity to solve problems. The activists involved in the North End WiFi network, and other grassroots organizers in Detroit, not only aspire to build key infrastructures and services but, in doing so, aim to create mechanisms for control, agency, and economic opportunity within their local communities. The Commotion wireless system, which the North End activists were using, was unique with its focus on resisting surveillance and enabling private peer-to-peer communications. I discuss the political backstory of how the U.S. State Department funded the development of Commotion with the goal of supporting activists abroad and then cut funding when they discovered Commotion was being used domestically. The case study is an example of how digital networks are embedded within and shaped by a multiplicity of conflicting political, economic, and cultural forces.

4.1 The North End Neighborhood

The North End is one of the poorest neighborhoods in the United States. The neighborhood is made up of large craftsman style homes; most are abandoned and in a state of disrepair, but many of them remain structurally sound. For every house that stands there are several empty lots where demolished houses once stood. The neighborhood has many large oak trees and lush green grass in the spring and summer months. Some of the empty lots have been turned into makeshift parks, gardens, and farms. The roads are paved, but water mains under the road regularly break, creating pools of water. I was staying with Chris, who I met through Airbnb, an online rental service that matches homeowners with short-term tenants. Chris and I were squatting in an abandoned house in the North End that he was fixing up. An example of informal ownership, I helped Chris seal the broken windows with wood and plastic sheeting we found in a pile of trash outside the house. Inside the house there were empty food cans and other trash left behind by a previous squatter, as well as family photos and 4th grade homework with handwritten dates from 2001. Among the homework there was a lottery ticket. I pointed this out to Chris and he replied, "It's the Detroit 401K."

Chris ripped out the bathroom and installed a new bathtub and toilet. Mindful of the lead dust, he hung tarps across the doorways. With no working electricity or plumbing, staying at the house felt like indoor camping. We were not alone in this style of living; an older woman lived down the street in a large dilapidated house with no electricity. She had hundreds of stuffed animals on her porch. Homelessness in Detroit often involves squatting in abandoned houses. For Chris, the difference was that he was actively taking steps to repair the house and claim formal ownership. Once he was the official owner of the house and it was fixed up he planned to rent it out using

Airbnb. With a settler mindset, Chris was an example of what I like to describe as an Airbnb homesteader. Airbnb homesteaders tend to be white and educated, and they tend to move into depopulated poor African America neighborhoods, like the North End.

The North End neighborhood was part of a larger borderland between the two Detroits. The first Detroit was geographically at the center of the city and it involved white collar professionals and fancy coffee. It was actively being rebuilt. The second Detroit involved fast-food, EBT cards, laundromats, and substandard housing. The second Detroit was being demolished, falling apart and abandoned, but still home to many. The geographic boundary between the two Detroits was fuzzy, but it was the byproduct of city planning; the recently built Qline trolley was one clear symbol of this. The trolley car's last stop almost came to the edge of the North End neighborhood. Many of the abandoned houses in the North End had official city demolition notices taped to the front of the house. A self-described "preservationist," Chris would drive around the North End looking for houses with demolition notices. Chris would rip the notice off any house that looked structurally sound, and in some cases even helped find people to purchase the house.

After a week of squatting with Chris I went to Ben's house so I could use his shower and toilet. Ben had been instrumental in some of the first wireless community networks in Detroit. We had met earlier in the year after I came across some blogs and online videos documenting his wireless networking efforts. Roughly a decade earlier Ben had unknowingly moved into a house that was outside of Comcast's internet coverage area. With no sign of Comcast extending coverage to his home, Ben built a wireless network with a neighbor who had Comcast service.

Ben's situation was not uncommon in Detroit. Comcast was the de facto monopoly internet service provider for most of the city, and their coverage was fragmented at best. A combination of poverty and limited coverage meant an estimated 40% of Detroit households had no residential internet access. A self-described socialist with a personal history of activism, Ben began helping his neighbors and other local community groups build their own networks to share internet access.

While Ben was one of the first people in Detroit building community networks, he was using open source tools developed by activists and idealists from around the world who were involved in similar efforts (Flickenger 2007). Since the establishment of the 802 family of wireless standards in the late 1990s and early 2000s, radio and internet activists coalesced around the belief that radio frequencies should be treated as a public good and that the internet should function as a decentralized commons (Dunbar-Hester 2014). After several years of helping different community groups build wireless networks, Ben became part of a new coalition of activists and local organizations focused on community networking. The coalition was organized by the non-profit Allied Media and became known as the *Equitable Internet Initiative*, and later the *Detroit Community Technology Project*. The group was focused on developing a curriculum that combined hands-on networking with a critical pedagogy focused on the politics of digital technology (Gerety et al, 2015).

North End WiFi Network and Ulysses' Vision for the Future

The next morning, after spending the night at his house, Ben introduced me to his friend Ulysses and Ulysses' adult step-daughter Victoria. Ulysses ran a small design studio, called "Red Door Digital," in the North End. At the time Red Door Digital was one of a handful of businesses open in the neighborhood and the only business in the immediate area. As part of the Detroit Community Technology Project, Ulysses had been trained to build wireless networks. From his design studio Ulysses was hosting the "North End WiFi" network.

Standing outside his studio, Ulysses pointed to several omnidirectional antennas and routers he had installed on neighboring buildings. In his early fifties, Ulysses had a youthful enthusiasm. His face lit up with excitement while describing the North End WiFi network and the future of the neighborhood. "Once we get another business out here, I'll extend the network, first wirelessly then we'll wire it… We'll have three public IP addresses and a local firewall. We'll be able to filter and monetize our own advertising with a public access splash page." Ulysses' internet service provider was Comcast, but Ulysses was looking to raise ten thousand dollars to pay Rocket Fiber to extend their high speed network to his building. At the time Rocket Fiber was a new internet service provider owned by local billionaire Dan Gilbert. Their coverage area had been limited to downtown, but they had recently extended their coverage with the building of the Qline trolley car (Nagl 2017). Ulysses was confident the difference in bandwidth warranted finding the ten grand. Organizers from the Detroit Community Technology Project had negotiated a discounted rate for their affiliated community networks. In an interview I conducted with the CEO of Rocket Fiber, he described the partnership as part of a broader good will campaign to support free Wi-Fi as they grew their coverage area beyond downtown Detroit.

Extending Rocket Fiber's network to Ulysses' building was a textbook example of an "economic tussle" (Clark et al. 2005). There is the foundational design question of where and when to build the fiber network, and then there is the runtime economic tussle over the ongoing service cost. Economic tussles over the cost of service delivery tend to reside at the edges of the network. Wireless community networks were directly bound to this tussle over cost. It was one of their driving motivations.

According to Ulysses the North End WiFi Network's coverage area was over two square miles. Ulysses explained that North End WiFi network would serve the community while also being a for-profit business. "We'll be providing free internet for the community, but it's going to be a business." While Ulysses was not entirely clear what the business model would be, he was certain that having a private intranet or firewall demarcating the North End with its own network, would be an important first step in turning the neighborhood into a business. By hosting a wireless network, Ulysses would be defining the possibility of future tussles with the local community that would be relying upon his network. For instance, consider the idea of the firewall that Ulysses mentioned. Firewalls are network security systems that monitor and control ingoing and outgoing network traffic. Often used by businesses for security reasons, firewall systems enable network administrators to design information policies that block specific websites or entire categories of websites and applications. In the context of an elementary school or business, the idea of enforcing information policies that are designed to protect children or secure intellectual property seems reasonable. But how do these same decisions and hierarchical relationships of visibility and control apply to a community?

Later in the day over a beer, Ulysses explained, “I’m an anarchist, I say fuck the government, they’re not helping us, let's build the neighborhood into its own corporation.” Ulysses explained how he had acquired several solar generators and was planning to build a rainwater catchment and treatment system. Victoria explained how they wanted to build a DIY fabrication space. “We can use CNC and 3D printing machines to fix the street lights and water mains that keep breaking.” It often took weeks, if not months, for the city to fix broken water pipes. They described a steampunk vision of the future that in Ulysses’ words was going to be “a mix between a theme park and a catholic monastery.” Building the North End WiFi Network was simply one of many steps in reaching for their vision of the future.

a sculpture where a house once stood, the North End neighborhood of Detroit, 2017

When Ulysses first explained his idea of incorporating the neighborhood I had a visceral cringe. But the more I learned and the more time I spent in Detroit the more I came to understand his perspective. Ulysses and many other residents of Detroit had a deep skepticism and mistrust of government. And on the most obvious of levels, the idea of incorporating the neighborhood was already on display throughout Detroit. Numerous non-profits and foundations had claimed entire neighborhood as their territory, maintaining the local infrastructures and offering a range of services. And finally, however undemocratic, there is a notion of group identity that comes with a corporation. The Latin root *corpus*, translates to "body," in this sense, to incorporate is to

recognize a social body.

A Web of Significance for Understanding Ulysses and North End WiFi Network

Ulysses' anti-government sentiment was common. Many Detroit residents I met during fieldwork had given up on the idea that government could improve their situation. The loss of faith in government was not entirely unwarranted. All levels of government seemed to lack the ability or the political will to address the complex challenges of poverty in Detroit and other rustbelt areas (Ryan 2014). Only a short drive away, the city of Flint was experiencing a prolonged water crisis, where neglected water mains were contaminating the tap water, making it unsafe to drink. The Flint water crisis was the byproduct of decades of economic decline and criminal neglect (Davey 2016). In Detroit, the campaign to demolish over 40,000 homes exposed residents, most notably young children, to toxic lead dust and asbestos (Williams and Householder 2018). For houses and neighborhoods considered salvageable, such as the North End, the Land Bank was established to run online auctions of abandoned and foreclosed upon properties. Detroit had a persistent tax-foreclosure problem. In many cases the enforcement of tax-foreclosure accelerated the abandonment and blight of neighborhoods (Dewar, Seymour, and Druță 2015). For those that stayed in their homes, it was far more likely their property would be auctioned online, facilitating a cottage industry of bargain basement slum lords (Runyan 2017). While the Land Bank auctioning system was well publicized and easily available online, the applications to avoid tax-foreclosure were mostly offline, confusing, and not well publicized (Oberholtzer 2015). But these are recent grievances; in many ways the loss of faith in government was a self-fulfilling prophecy with historic roots in early twentieth century welfare capitalism.

Welfare capitalism was the belief that private corporations should oversee the distribution of welfare benefits. It was based on a paternalistic belief that upper-class white men knew what was best for their workers, and by extension their families (Brandes 1984). Fordism, a populist ideology closely aligned with welfare capitalism, positioned the Ford Motor Company at the center of Detroit's economic and moral life (Gramsci 2000). The power that Ford managed to consolidate was reaffirmed by the oppositional forces of the labor movement, and black power communists that looked to the factory as a site for revolutionary organizing (Georgakas and Surkin 1998).

The League of Revolutionary Black Workers were the subjects of FBI surveillance and union harassment (Georgakas and Surkin 1998). This was happening within a broader context of low-income African American communities being over-policed and underserved. The crack cocaine epidemic of the 1980s ravaged low-income communities in Detroit (Mieczkowski 1994). While talking with longtime residents about the recent history of Detroit and their neighborhood, people would often mention the crack cocaine epidemic of the 1980s. Nearly everyone who told me about the violence that came with crack explained how its movement and sale was partially orchestrated by the Central Intelligence Agency (CIA). While the CIA's involvement is disputed, there is evidence to support the claim (Webb 2011). The point, however, is not about crack cocaine or the CIA but rather the deep-rooted mistrust of government and law enforcement that understandably emerged within Detroit's low-income African American communities.

The eventual decline of the auto industry, which accelerated by the 1970s, not only brought

economic hardship but marketed a profound cultural amputation from the institutions that provided a sense of economic and social order, even for those that were characterized by their oppositional relationship to the auto industry (Sugrue 2014). With factories being closed, the de-radicalized labor movement experienced a historic decline and the black power Leninists remade themselves into anarchists. This transition was chronicled in the writings of Detroit scholar and activist Grace Lee Boggs (Boggs and Kurashige 2012). Rather than seizing the means of production which had been abandoned and were becoming industrial ruins, the "Boggs school" looked to communitarian strategies for building local agency and spaces for community support as a way of resisting hegemonic systems of power. Through her writing Boggs articulated and reflected on the ideas of those around her and, in turn, influenced several generations of Detroit activists, including many of the people involved with community networking. Boggs' ideas and writings were also representative of a larger shift in the American left away from a Marxist orthodoxy and towards an anti-authoritarian focus on local communitarian ideals (Dixon 2014). Many of these ideals would become synonymous with the global justice movement and later the Occupy movement (Hammond 2015). Through my interviews I found there were overlapping ideals and an intermingling of people between wireless community networking and the global justice and Occupy movements. In many cases these protests became testing sites for implementing new wireless technologies (Singel 2011).

The decline of the auto industry in Detroit also had direct consequences for the municipality. With people leaving the city and the loss of factories, the municipality experienced a steady decline in tax revenue, which eventually lead to a wave of privatization (Farley 2017; Smith and Kirkpatrick 2015). Public services would be closed and often replaced by non-profits financially

backed by private foundations, such as the Ford Foundation. Over time a collection of non-profits grew in scale, claiming entire neighborhoods as their territory, effectively running much of the city. A foundation-funded system of non-profits emerged, often looking to smaller grassroots initiatives for new "models" for community engagement and economic development. In this sense, the Detroit Community Technology Project and the North End WiFi network were examples of possible models for social impact that were competing for attention and long-term funding from private foundations in the area.

Narrative Capitalism

Organizers trying to build something at the grassroots level in Detroit have learned to sell their imaginary vision of the future. Down the street from Ulysses there were more accomplished examples of grassroots organizing, including an urban farm focused on prison rehabilitation and food justice (Shaw 2019) and a matriarchal eco-village-focused sustainable neighborhood revitalization and youth mentorship (Thibodeau 2016). In each example, storytelling not only provided a sense of direction and vision for their immediate community, it played a key role in raising money. Storytelling was an important part of vying for grant funding from private foundations or raising money on crowdfunding sites. As an outsider visiting Detroit, it became clear that my presence often evoked well-rehearsed stories. It is a dynamic I have come to think of as *narrative capitalism*, where those without money are compelled to tell stories that illustrate long standing tropes of the bootstrapping citizen, self-reliance, and the deserving poor. These tropes are the byproduct of one-sided narratives being evaluated from a white middle class, or affluent, perspective that looks at the poor from a perennial state of suspicion.

The notion of the deserving poor is a way of discerning those that have legitimate hardships and grievances from those that are perceived as lazy and lacking willpower or good character (Will 1993). The notion of self-reliance is wrapped up in ideals of personal responsibility and the choices one makes. As a cultural myth, self-reliance is a way of minimizing the circumstantial differences and structural dynamics of poverty and inequality. The myth of self-reliance is of course closely intertwined with the idea of the bootstrapping citizen. Bootstrapping is another way of describing the meritocratic lens through which middle class America views itself. It is a world where hard work translates into economic upward mobility (Littler 2017). The idea that poor communities and individuals have agency and responsibility over their lives is not a bad idea, in fact many of the projects that use these ideas to describe themselves are doing important work. The problem is how these ideas are used to manage the distribution of resources. In the case of narrative capitalism these myths are repackaged into compelling stories that move through a system of power that may, or may not, deem them deserving of resources. This process is formalized through the administration of private foundations and in the design of online crowdfunding platforms.

The aforementioned matriarchal eco-village was an interesting example of how a self-produced video on a crowdfunding website was used to raise a quarter of a million dollars. The success of their campaign led to media coverage, which in turn lead to additional donations and access to resources (Abbey-Lambertz 2016). Through the use of online videos and photos, these narratives circulate on social media and other online publications, unlocking access to resources while simultaneously propagating the idea that self-reliance is the solution to poverty. Of course, for every success story that comes out of this process, there are countless people that simply

continue to struggle with the challenges of poverty.

In the context of Detroit, the dynamic of narrative capitalism is closely tied to the promise of reinventing the city. As I discussed in the previous chapter, the history of Detroit is often organized around the master narrative of Detroit's industrial rise, decline, and its much anticipated reinvention (Sugrue 2014; Smith and Kirkpatrick 2015). While there are some radical visions of the future (Boggs and Kurashige 2012), the reinvention of Detroit is often described as a reinvention of industry, involving digital technologies and expanded internet access (Segal 2013). In this sense, the narrative of wireless community networking and the Detroit Community Technology Project combines the desire for a hi-tech digital future with notions of social justice, while simultaneously playing on the tropes of self-reliance as the solution to poverty.

"Meet the People Building Their Own Internet in Detroit"

Back in Los Angeles, I received an email from Ulysses, who mentioned that they had successfully extended the network to cover over two square miles of the North End. This was followed by a web address for a short documentary. The documentary was produced by Vice media and was about community networking in Detroit. The video file and web page were titled *Meet the People Building Their Own Internet in Detroit.* The video opened with footage of dilapidated homes from the passing window of a car, followed by a written quote from the Detroit community technology organizer Diana Nucera. "We risk our human rights if we don't take ownership and control over the internet in a way that is decentralized" (Ferreira 2017). The video then introduces Diana Nucera, aka "Mother Cyborg," who discusses the "sad" state of internet in Detroit. She goes on to describe a global network of fiber cables connecting

continents and cities, with internet service providers connecting at regional internet exchange points.

Screenshot: Vice Motherboard documentary, Meet the People Building Their Own Internet in Detroit, 2017

"So that is where we come in. We need to build our own infrastructure and rethink internet service providing and access in order to reach those people that have normally been left out or marginalized." The video goes on to depict community networks in three neighborhoods, the North End, the Southwest, and Islandview. In the Southwest segment of the video, they show a network organizer standing on the roof of a church called Grace in Action. Grace in Action had partnered with networking activists to share their Comcast internet connection with the church's immediate neighborhood. Standing on the roof of the church, the network organizer points to an omnidirectional antenna at the top of the building. "With this we can talk with the owners of the

liquor store and the owners of the body shop." There is something reassuring, maybe even quaint, about building a wireless connection between the local church and liquor store. In a later segment, the same organizer that was standing on the roof is standing in a nearby alley. "This is an example of a public space. Some of the neighbors come over to do their homework in the alley because we share the Wi-Fi. A lot of people right now go to McDonald's for Wi-Fi." During my fieldwork I repeatedly heard the idea of "homework" coming up in conversation with internet activists and network administrators at the public library. Homework was an ideal use case when discussing internet access. As a concept, homework signals that the community deserves internet by virtue of their hard work and personal responsibility. To be clear the internet *is* being used by students to do their homework, but it is also being used for a much wider range of needs.

Towards the end of the video they show one of the activists standing outside someone's home. "This is a beautiful thing to be a part of, because the faces that these people see" they point to the house behind them, "are the same people who installed it, the same people who are protecting their privacy, and the same people that will come back and be like you have a problem, how do we fix that? you know." They describe a level of coordination and work that begins to resemble a small business. According to Ulysses, the Detroit community technology project was operating in a murky middle ground between being an educational initiative and attempting to be a service provider. Ulysses felt these functions needed separation, and that the educational curriculum needed clear measureable outcomes, which he argued should be passing the admissions test for the International Brotherhood of Electrical Workers.

The Vice documentary focuses on the idea of low-income communities taking direct action to bridge digital divides and share internet access. To drive the message home, the video concludes with Mother Cyborg warning that we might create a "digital class system." The reality is that we already have deeply entrenched socioeconomic classes, the distinctions of which are intertwined with digital technologies. The extent to which class becomes "digital," and becomes an automated "system," is nevertheless a critical issue. In the book, *Automating Inequality: How High-Tech Tools Profile, Police, and Punish the Poor*, Virginia Eubanks (Eubanks 2017) describes a history, starting in the nineteenth century, of how welfare systems have consistently shamed the poor and looked at them with suspicion. Eubanks argues, with clear empirical examples, that this history and cultural bias has led to the design of digital welfare systems that are invasive in terms of surveillance and data collection, and punitive in how they automatically profile people. While the Vice documentary is focused primarily on the idea of bridging digital divides through direct community action, the Detroit community technology project's self-published zine *(Re)Building Technology v1* foregrounds the issue of political power and need to resist surveillance.

The zine authors frame "community-based technology" as resisting government and corporate surveillance and hegemonic "systems of control." While the definition of community-based technology remains hard to pin down, it is described as involving decentralized ownership and control, and "rich with lessons in what the role of technology can be to restore neighborhoods, build new relationships, and develop new systems that encourage collaboration and creativity." (Gerety, Gunn, and Nucera 2015) The idea of community-technology described in the *(Re)Building Technology v1* zine is an example of a how technologies can be used to reimagine

social poetics. In his reading of Heidegger, the technology scholar Ramesh Srinivasan reminds us that *techne*, the root of technology, was interpreted as not only products and tools but as the poetics and aesthetics of the mind. "Techne" Srinivasan writes, "reveals the ways in which human societies make and articulate knowledge, speaking to social poetics and cognition." Srinivasan argues that the design of digital technologies and the internet "reveal underlying ontological beliefs around how the world should be ordered" (Srinivasan 2013). In this regard, there are clear cultural and political implications for the design and use of technologies. At the same time, there are political and social problems that are mistakenly described as having technical solutions.

In both the *(Re)Building Technology v1* zine and the Vice documentary it is argued that the internet should be "decentralized" in its design and ownership. This vague notion of decentralization is framed as tantamount to classic notions of liberty. The decentralized community-owned internet not only protects against outside interference. It enables the positive liberties of acting upon one's free will.

The idea that liberties can be protected and enabled through the design and use of internet technologies played a central role in persuading the U.S. State Department to fund the development of Commotion wireless - the wireless toolkit Ulysses and other community activists were using in Detroit. In the next section, I discuss the political backstory behind the design of Commotion wireless and how the State Department's institutional priorities enabled and eventually stymied the development and implementation of Commotion wireless.

4.2 Commotion wireless

In January of 2011 a mass protest movement took hold in Egypt. By early February the Egyptian government attempted to shut down all internet access in the country, including mobile networks. Some foreign internet service providers offered free dial up connections to those attempting to access the internet through Egyptian landlines, but internet access remained limited. The shutdown lasted five days and the U.S. State Department took note. Prior to the Arab Spring the U.S. State Department's "Internet Freedom" policy funding had been used to support the development of circumvention technologies with the goal of helping activists in authoritarian regimes combat censorship and protect private communications (MacKinnon 2013). Following the Arab Spring, State Department's Internet Freedom funding went to support a wider range of projects. The New America Foundation's Open Technology Institute became the State Department's one stop shop for supporting the development of activist-oriented internet technologies.

Sascha Meinrath, the founding director of the Open Technology Institute, had nearly a decade of prior experience organizing and studying wireless community networks and advocating for municipal networks. The genesis of Meinrath's involvement with wireless community networking went back to the late 1990s with his involvement with Indymedia, a network of media collectives and progressive journalists that were loosely associated with the global justice movement. In an interview I conducted with Meinrath, he explained that they were interested in using digital technologies to build "alternative community-owned and operated infrastructure" that would enable communities to "control their own narratives." While most internet users still had dial up, Meinrath was arguing that community and municipal broadband would contribute to

economic and social justice. Meinrath and his friends began building experimental community networks and hosting an annual international conference. “There was no monolithic entity, nor was there a singular goal, but we were all relatively aligned around the same goals of spreading low-cost connectivity, secure communications… and applications that would run on local area networks.”

By 2009 Meinrath was in Washington D.C. giving talks to raise money for the Open Technology Institute. He was invited to give a briefing at the State Department, where he talked about the need to implement secure on-the-ground communications. He argued that the State Department should support the open source ecosystem that was already working to develop secure and distributed communication tools. The Arab Spring happened shortly thereafter. After tracking the internet blackouts in Egypt the State Department agreed to fund the Open Technology Institute. “It was one of those rare alignments of priorities,” Meinrath explained. The Open Technology Institute invested millions of dollars into a number of open source projects. Most of the projects were explicitly focused on supporting secure communications, and many of them were eventually packaged into Commotion wireless. Occupy Wall Street encampments were one of the first test sites for Commotion. Media outlets caught wind of the story and dubbed it the “internet in a suitcase.” In an interview with *Wired* magazine, Meinrath described the goal of the Commotion project as supporting decentralized peer-to-peer communications that could resist despots looking to crack down on communications and internet access (Singel 2011). In addition to the high profile cases of government imposed internet blackouts, there had also been numerous documented cases where the internet’s standard security protocols had been compromised.

With the development of the World Wide Web came the web browser, and while there is much to say about the important role web browsers played in popularizing the internet, the key point for our purpose was the development of the Hyper Text Transfer Protocol Secure, or HTTPS, by Netscape Communications in the early 1990s (Cusumano and Yoffie 1998). Building on the X.509 standards for public key certificates that were established in the late 1980s, the secure socket layer protocol, or SSL, and HTTPS were packaged as part of the Netscape web browser. This marked the beginning of the standard practice of shipping web browsers, and later mobile phones, with a preinstalled list of trusted certificate authorities (imagine the small lock icon often found near the top of the browser). The design of the web browser is thus a centralized point of control that relies upon the decentralized system of certificate authorities. The certificate authorities act as a trusted third party that verifies the website you are visiting is who they say they are. The certificate authorities issue a hierarchical tree structure of certificates, and any certificate authority can verify any website. This last point turned out to be a liability, and a key example of what David Clark identifies as a tussle over "trust" (Clark et al. 2005). Trust-based tussles tend to involve criminality, or political conflict and intelligence operations. Corrupted certificate authorities, or those under the control of an adversary, could easily perform man in the middle attacks on what would otherwise look like secure communications. A classic example occurred in 2011, when unknown actors from Iran compromised the Dutch certificate authority DigiNotar to intercept the communications of hundreds of thousands of Iranian Gmail accounts (van der Meulen 2013).

With these documented vulnerabilities in mind, the Open Technology Institute directed funds to

Open Whisper Systems, an end-to-end encryption protocol. Open Whisper Systems was eventually packaged with the Commotion toolkit. This meant that in addition to using the SSL/TLS certificate system, the Commotion-hosted applications would run their own encryption protocol. For communities concerned with the dragnet surveillance associated with popular online services, a locally hosted intranet of applications would, in theory, offer them an alternative. Additionally, the functionality of the local intranet was not dependent upon upstream connectivity to the broader internet. If access to the global internet were to fail, the local intranet could continue to function, assuming one has access to electricity. By chance this scenario was demonstrated with one of Commotion's case study implementations.

Following several years of software development, the Open Technology Institute began funding case study implementations. The funded case studies included a community network in Sayada, Tunisia, Brooklyn, New York, and Detroit, Michigan. Tunisia's recent history of authoritarianism and democratic reform, along with the fact that it was an international site, made it the most overtly tied to State Department interests. In Detroit, funding from the Open Technology Institute helped launch the Detroit Community Technology Project, the same group that trained Ulysses to build the North End WiFi network. In Brooklyn, the RedHook WiFi network became known for being the only communication network in the area to withstand hurricane Sandy in October of 2012. The story of Red Hook WiFi and hurricane Sandy quickly became a cited example for those arguing that community networks are useful in the event of a natural disaster (Butler 2013).

Hurricane Sandy caused widespread power outages across Manhattan and Brooklyn. The small

nonprofit, Red Hook Initiative, which built the RedHook WiFi network, happened to be in one of the few buildings that continued to have electricity. While access to the broader internet went down, along with most telecommunications, the locally hosted Commotion intranet continued to work. By all accounts the success of the RedHook WiFi network following hurricane Sandy was in its ability to facilitate a shared situational awareness of needs. The intranet was used to share safety updates and coordinate help. The Federal Emergency Management Agency (FEMA) made use of the network, extending the coverage area by turning antennas on neighboring buildings back on using emergency batteries. Within days access to the broader internet was reestablished through a satellite connection, while power, water, and communications took nearly a month to returned to normal. But what constitutes normal? During my fieldwork in Detroit people repeatedly described Detroit as a "disaster." But what does it mean when the disaster is not a discrete event like Sandy, but rather decades of economic and political decline?

The Paradox of U.S. Internet Policy

Following the case study implementations, Meinrath and the Open Technology Institution had planned for a phase involving widespread implementation of Commotion wireless, but this plan was never realized. According to Meinrath, the State Department was supportive of secure communications for activists abroad whose interests aligned with those of the United States. However, following the Edward Snowden leak, tensions grew as leadership at the State Department became increasingly uncomfortable with domestic implementations of Commotion. For Meinrath the experience exposed the conflicting interests within U.S. government. As he described it, there was an "incredible paradox of US policy making" between a desire to secure data and communications on the one hand and a desire to surveil on the other.

> *Because Commotion was built from the ground up for security in dangerous environments, the concern was raised, where is the backdoor that allows law enforcement to surveil domestic communications? Well, there isn't one. It's a secure communications medium. That spooked a lot of folks, including the higher ups in the State Department… So the State Department said Great, we're not going to fund this project anymore*

The State Department cut the Open Technology Institute's funding, effectively freezing Commotion wireless' development and case study implementations. This did not however stop the development of Open Whisper Systems, which eventually led to the development of the Signal Protocol and the Signal messaging app. As of 2019, the Signal protocol is one of the most widely used end-to-end encryption systems, used by Skype, Google, WhatsApp, and many others. According Meinrath, this was one of the long-term outcomes of the Open Technology Institute's use of State department funds. While the subsequent success of the Signal Protocol means a sizable percentage of the internet's communications are protected by additional encryption, the security is as good as one's faith in the companies that run the applications. Nearly a decade after the Commotion project started, many of the concerns regarding surveillance that motived the Commotion design have only become more pronounced and commercialized (Zuboff 2018). The capacity to design technologies that align with certain values is measured not only by their outcomes but by their ability to resist counter moves by those with conflicting interests. But our capacity to self-consciously design systems that embody specific values is extremely limited, and many of the problems that people hope to solve using technology remain at their root societal issues of trust and conflict.

4.3 Conclusion

The community wireless case study provides an empirical example of how heterogeneous forces, such as institutional priorities, political interests, and cultural values inform the design, configuration and use of internet-related technologies. To evoke the multi-tussle framework, the State Department funded development of Commotion wireless is the design-time aspect of the case study, while the configuration and run-time aspects of the case study involve community activists in Detroit. As I discuss at length in chapter 7, secure communications and trust related issues were a top priority for the Commotion system designers, but when one examines the configuration and run-time aspects of the case study one finds economic concerns were a top priority for community activists. Thus, community network activists are first and foremost engaged in a transactional economic tussle with commercial internet service providers. As 'community' activists, they claim to represent the interests of their community, thus mediating a transactional economic tussle on behalf of those using the network. Implicit to the work of community network activists are the trusted relationships with the community of people using the wireless network. While the community activists I met did not write formal terms of service, there were implicit expectations regarding appropriate and acceptable behavior or use of the network. This included criteria for extending their coverage area to new homes. The relationship between community members and activists administering a wireless network involves numerous trust-related issues that work in a tacit manner. For a more exhaustive multi-tussle analysis see chapter 7.

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Chapter 5: Parkman Library

Throughout my fieldwork I repeatedly found the Detroit Public Library to be one of the most important spaces for supporting internet access and computer use for low-income communities. In this chapter I pull from my observations and interviews at the Detroit Public Library, focusing on a small neighborhood branch known as the Parkman Library. The central findings in this chapter center around the role of "frontline mediators," a phrase the librarians use to describe their work in supporting the use of online welfare applications. I theorize the key attributes of frontline mediators and examine the history of universal service policies that support internet access at public libraries, arguing that the role of the frontline mediator is an unintended byproduct of universal service policies.

5.1 The Parkman Library

It was summer time, and compared to Los Angeles, Detroit was hot and humid. I was riding my bike across the city. I was on my way to meet several librarians at the Parkman neighborhood branch of the Detroit Public Library. The Parkman Library is located in a neighborhood called Hope Village. Six miles from downtown, Hope Village is well within the depopulated and heavily blighted area of the city. The population of Hope Village has been steadily declining for years, but compared to the surrounding area it remained relatively populated. The name Hope Village came from the local non-profit Focus: Hope, which was started by a catholic priest after the Detroit riots, or "rebellion," of 1967. Focus: Hope initially offered vocational training for the auto industry, but in the 1990s shifted the vocational training to information technologies. For years the unemployment rate in Hope Village hovered around 40%, with roughly half of neighborhood residents living below the poverty line. Decades of economic decline meant

Focus: Hope eventually adopted a more holistic place-based approach to its programming. This involved a wider range of services such as childcare, food, wellness programs, housing, and the maintenance of local infrastructure. In this regard, Focus: Hope was a textbook example of how non-profits with foundation money came to run entire neighborhoods in Detroit.

mural from Hope Village, 2017

Down the street from Focus: Hope was the Parkman neighborhood branch of the Detroit Public Library. In the depopulated parts of the city the neighborhood branches of the Detroit Public Library were one of the few public services that remained open. In 2016, in an article for the

New York Times, Cecilia Kang described the Parkman Library and the Hope Village neighborhood as examples of a digital divide, arguing that the difficulties of poverty and unemployment were compounded by illiteracy and limited internet access (Kang, 2016).

Arriving there for the first time, the Parkman Library was easy to spot with its well-maintained brick and decorative stonework. Outside the main entrance were several people standing around looking at their phones. Inside, the Library's main rooms were full of desktop computers. While the Library's walls were lined with books, the computers were at the center of everyone's attention. Adjacent to the computer was a long table surrounded by people on their phones and tablets. Across from the main help desk was a large easel with a colorful poster that asked "What do you like best about the Parkman branch?" Below the question there was a list of services: books, DVDs, Internet access, library workers, kids' activities, e-books/e-music, photocopier, computer classes, and small business consulting. Next to each service there were red circular stickers indicating someone's preference. Internet access was the clear winner.

In 2011 the Parkman branch was renovated, making it the only neighborhood branch with a "TLC Center" or Technology, Literacy, and Career Center. The TLC center hosted a monthly schedule of classes focused on basic literacy, computer skills, job seeking, and entrepreneurial counseling. The Center included an area for printed announcements, which mostly listed jobs at nearby fast-food restaurants and a notice about an increase in the state's minimum wage from $8.50/hour to $8.90/hour. The computer lab in the adjacent room had four long rows of desktop computers. It was packed with people. There was a man looking at pornography and a couple of kids playing a game of solitaire together, but most of the people were filling out online welfare

applications. The desktop computers had a session limit of one hour, which meant the turnover was relatively quick. It also meant that, for adults filling out welfare applications, there was a focused task-oriented approach to computer use. Next to the computers was a table with people casually scrolling their phones. Some had open notebooks and seemed to be attentively doing something, while others were browsing at their leisure.

In 2010, the U.S. Impact Study found that Internet access was one of the most sought after services at public libraries (Becker et al. 2011). According to the study, 169 million people used public libraries and 77 million of them used library computers and Wi-Fi to access the Internet. Put in terms of total national population, roughly 69% of the population used public libraries and 32% of the total population used the public library to get online. When focusing on those living below the federal poverty line, this last figure jumped to 44%. According to the Institute of Museums and Library Services' (IMLS) 2016 survey data of public libraries, the Detroit public library's 23 branches had 441,405 users (or roughly 65% of the city's estimated population), the library's 712 public computers that were used 647,833 times, and the library's Wi-Fi network had 101,498 unique sessions ("Public Libraries Survey 2016" 2016). The IMLS survey data and U.S. Impact Study substantiate my own observations that the public library's support of internet access and computer assistance was popular and well used.

The U.S. Impact Study also looked at Internet use and found a common set of uses for the library's computers and Wi-Fi, which included: maintaining social connections, education, employment, health and wellness, government and legal services, and community engagement, personal finances, and entrepreneurship. For low-income populations relying on welfare benefits,

the importance of the public library was compounded by a national trend to move welfare applications online. Across the country state agencies began requiring people to use online applications, and in the process directed them to public libraries for internet access and computer assistance. John Carlo Bertot from the University of Maryland described the public library's support of e-government services as an "unfunded mandate" (Bertot et al. 2006; Bertot, McClure, and Jaeger 2008; Bertot et al. 2009). This led to a new set of challenges and emergent work practices for librarians and library staff. In an interview I conducted with Margaret Gillis Bruni, the Detroit Public Library's director of public services, she used the phrase "frontline mediators" to describe the work performed by librarians to support the use of online government services. The term "frontline" evokes metaphors of war and disaster, akin to the idea of working in the trenches, a phrase I also heard used by librarians to describe their work. As "mediators," they are facilitating an exchange of information between two or more parties. This also means they facilitate internet tussles involving their customers.

5.2 "Frontline Mediators"

In a room full of people sitting at computers filling out online welfare applications, Sharon was moving quickly from person to person. She was helping her customers troubleshoot their welfare applications. Sharon and her colleagues had made printed booklets with step-by-step instructions for the most popular applications, but many people needed additional assistance navigating the computer. Periodically Sharon would return to her desk to scan someone's social security card or driver's license, or to hand out snacks to young children asking for food, which had become a notable service at the Detroit Public Library. Detroit's Wayne County has one of the highest rates of child food insecurity in the nation. In 2012, with funding from the Chrysler Foundation,

the Detroit Public Library began offering snacks to children any time of day, and full lunches to children who came to the library's summer reading program (Cottrell, 2014).

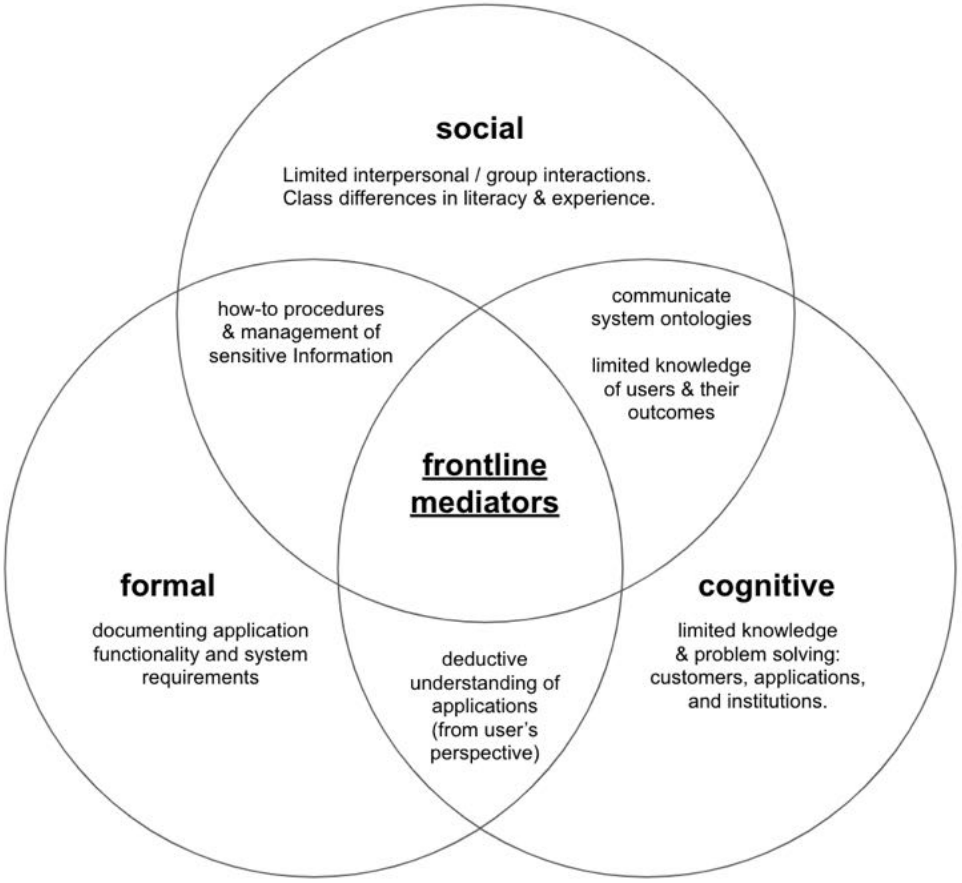
Eventually Sharon and I sat down in a small reading nook that was tucked away from the computers. Sharon explained that literacy was the persistent "number one issue" with her customers, with digital literacy being tantamount to basic literacy.

> *It's both literacy in terms of reading and comprehension, as well as computer experience; there are many people that don't understand what it says on the screen or the letter they get in the mail. They can bring it to me. I don't work at DTE [the local utility company], I don't work for the state, but this is what I think this letter is saying. That was definitely the issue when CHAMPS first rolled out. People got letters saying they had to enroll [on the website] and that they had to have an email address, and for many of the people in this community they've never used a computer and they've never had an email address.*

The letter that came in the mail instructing people to sign up for CHAMPS, or the Community Health Automated Medicaid Processing System, was a recurring story I heard from the librarians and library staff I interviewed. They all described a similar story of government agencies closing brick and mortar offices and using online applications in lieu of the face-to-face support. When people called the government agencies for assistance they were told to go to the public library. The agencies made little to no effort to communicate these changes in policy to the Library, which experienced a sudden influx of people looking for help with online applications.

This was an example of an inter-agency tussle over the cost of service delivery that was enabled by the use of online applications. In an attempt to improve efficiency, government agencies that

moved to online applications effectively transferred the costs of customer support to public libraries. Furthermore, the design of online welfare applications often assumed a level of literacy and familiarity with computers that in many cases was not representative of the people using the application. In this regard, the high level function of frontline mediators was to bridge formal and cultural literacy gaps between their customers' current knowledge and the expectations and assumptions that were built into the applications they interface with. The key attributes of frontline mediators can be organized around three overlapping areas that address social, formal, and cognitive functions.



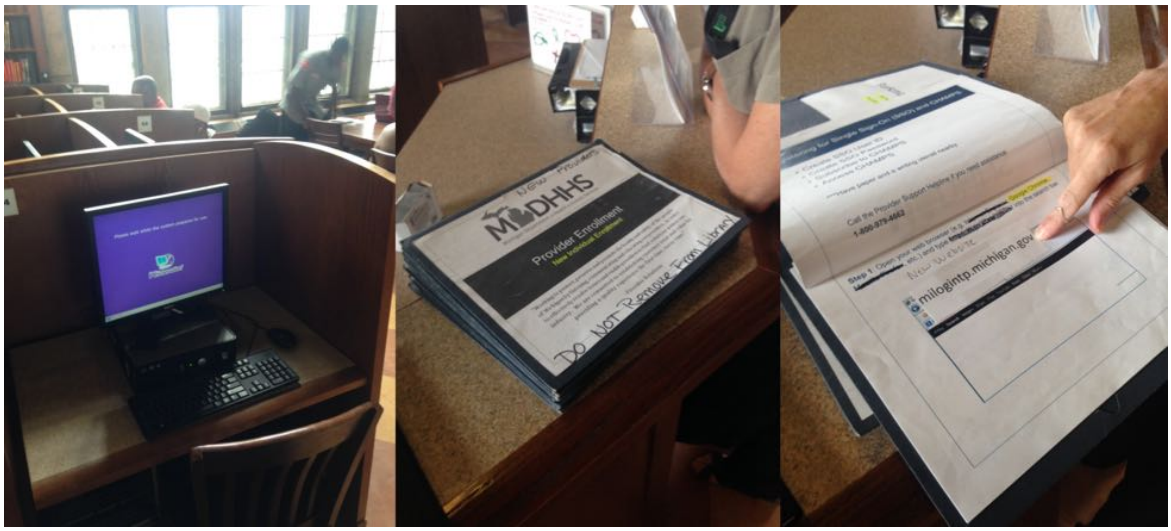
Face-to-face interactions with customers is a central aspect of the frontline mediator's social function. This involved how-to instructions for interfacing with applications, explanations of basic concepts and ontologies of operating systems, and the management of sensitive information, such as social security numbers, personal financial documentation, and system passwords. The how-to instructions involved the production of formal documentation with step-by-step guidelines for how one might use an application. Unlike system designers who, in theory, understand how an application works, the frontline mediator's knowledge of the application is almost exclusively derived from the user's perspective. Furthermore, this sense of limited knowledge was also a feature of their relationship with their customers. Despite recurring visits, frontline mediators rarely knew the detailed backstories or long term outcomes of their clients. I will now expand upon my description and analysis of the *formal*, *social*, and *cognitive* functions performed by frontline mediators.

Formal

Sharon's customers needed help in predictable ways. They came into the library for the same shortlist of applications, which included the Michigan health program "CHAMPS," the state run food stamps program "Bridge," and the Detroit Edison (DTE) energy company's proof of hardship application. Other applications were regularly used, including social media platforms like Facebook and YouTube, but CHAMPS, Bridge, and the DTE hardship application were the most common and central to the work of frontline mediators.

To facilitate the use of CHAMPS, Bridge, and the DTE hardship applications, Sharon and her colleagues produced documentation of system requirements and common application use cases.

Some of the documentation was internal to staff and was mostly focused on keeping track of system requirements, such as which web browser was needed for a particular application and if the application used pop-up windows or not. Updates and changes to the applications were ongoing but never directly communicated to librarians, which meant that changes were often discovered and documented when things stopped working.



booklet for CHAMPS enrollment, 2017

Other documentation was designed with public use in mind. Public-facing documentation took the form of printed booklets, which translated what would otherwise be a non-linear set of interactions into sequential steps, including guidelines for navigating the desktop operating system. For every application there were multiple printed booklets: a book with instructions for registering a new user account in the case of CHAMPS and Bridge, a book for the initial means testing for CHAMPS and Bridge, a book for monthly updates in the case of CHAMPS, and books for annual redetermination forms for both CHAMPS and Bridge. The booklets were well

used, with layers of application updates physically cut and pasted onto the pages.

Of course as means tested welfare systems, the user facing applications are part of a much larger institutional assemblage, involving layers of administrative and technical systems designed to determine and re-determine eligibility. With required monthly updates and annual re-determination procedures, the applications were designed to automate the means testing process and push people off benefits by default, forcing the poor to continually prove their poverty. In this regard, there is a transactional logic similar to any customer service provider relationship and the economic and trust-based tussles that characterize internet mediated transactions. Frontline mediators are caught in the middle of this tussle despite being aligned with the interests of their customers.

Social / Interpersonal

The booklets were used as part of a larger process facilitated by the librarians. When customers came in for the first time they often needed assistance signing up for their first email account. The CHAMPS and Bridge applications require scheduled updates. In the case of CHAMPS these updates were monthly. Through recurring visits the librarians and customers often built a sense of rapport, learning one another's names and talking about what they needed help with. Community members seemed to trust the librarians and this trust was on display with the handling of sensitive information. For instance, for the DTE hardship application, the librarians scanned and saved digital copies of their customer's social security cards, pay stubs, and other financial records. As Sharon explained, DTE users were part of predictable cycles of crisis.

> *When people come in for DTE Edison they're at a crisis point. They've gotten a notice in the mail notifying them that they're being cut off from the utility. They call DTE and say, "I can't pay" and DTE says "prove it." So then they come to the library. I use the copy machine to scan their documents and then put them on my flash drive and computer, so we can upload them on the website. I try not to be nosy, they trust me with their social security numbers and passwords, I try not to memorize them.*

The customer's limited experience with computers was a major factor in these interactions. While scanning or collecting documents, Sharon not only facilitated the various steps necessary to fill out the applications, but she often found herself explaining the properties of a digital file and its ability to be duplicated, shared, and accessed across multiple machines, a concept that was unfamiliar to many first time computer users and even some young adults who had smartphones.

The librarians I interviewed believed the push to move CHAMPS and Bridge online was motivated by a genuine desire to improve their service, but was nevertheless flawed by the bias of middle class system designers and administrators. As Sharon put it, "the people building CHAMPS and Bridge, they have Wi-Fi at their home, they have electricity at their house, they don't worry about having it cut off for whatever reason, they can't imagine it, it doesn't compute with their experience." Sharon repeatedly used the term "experience" as a proxy for class differences, a form of shorthand for how socioeconomic conditions relate to literacy and ways of thinking. While it is reasonable to assume the frontline mediators were more aware of their customers' needs and capacities than the application designers, it is also true that their face-to-face interactions were limited in scope, with little knowledge of their customers' long-term outcomes after using the applications.

Cognitive

In assisting customers with limited literacy using online welfare applications, frontline mediators are part of a long and ongoing history of textual intermediaries, such as street-corner scribes that read and write letters for their illiterate customers. In this regard, it would be easy to describe frontline mediators as information professionals that have knowledge and literacies that their customers need and stop there. But this description on its own misses a key aspect of their work. Frontline mediators work with explicitly limited knowledge; they have limited knowledge of their customers' personal history and long-term outcomes and limited knowledge of the agencies and applications their customers are interfacing with. The interaction they are mediating, between their customers and the government agencies, is characterized by clear asymmetries of knowledge and power. The people submitting the applications are concerned about submitting the right information so their benefits are approved, but frontline mediators rarely have answers regarding eligibility and means testing policies. As Sharon put it,

> *I'm not a social worker, I'm not an employee of DTE, I don't know what the rules are, I'm as much in the dark as my customers are. They're looking for an expert and I'm not it.*

By helping their customers interface with the CHAMPS, Bridge, and DTE applications, Sharon and her colleagues derived a conceptual model of how the applications worked from the user's perspective. As I discussed in the *formal* section above, changes to the application were discovered when things stopped working, requiring updates on their local computers. The printed booklets, with their layers of updates physically cut and pasted onto the pages of the book, offered tangible evidence of how their understanding of the application was derived from the

user's perspective and revised through a reactionary process of problem solving. With little knowledge of their customers' long-term outcomes and no communication with the agencies regarding their policies, the frontline mediators' understanding of a successful application was limited.

Applications are modular in their design and the core functions of the frontline mediator operate within this modular logic, acting as an interlocutor between the affordances of the application and the needs and capacities of the public. The CHAMPS, Bridge, and DTE applications are all online and designed to run in a web browser. The agencies that designed the applications also directed their customers to go to the library to use them. They were able to direct their customers to the library with confidence because the Federal Communications Commission's Universal Service Fund subsidizes internet access and telecommunications costs for public libraries and public schools. The allocation of money is determined by a formula that accounts for free lunch enrollment levels at the local school district, the population, and their geographic location, be it urban or rural ("E-Rate Eligible Overview USAC.Org" 2019). In this regard, the role of frontline mediators is tied to particular policy concepts of universal service that are explicitly aimed at networking public libraries. Similar to the work of front line mediators, the director of information technology at the Detroit Public Library spends much of his time interfacing with online subsidy applications that attempt to automate a complex means testing process. The criteria built into such systems is representative of a particular set of ideas about what internet access and universal service should look like in the United States.

5.3 The Institutional Topology of Universal Service

Detroit's residential internet coverage was slow and fragmented, and people living in poverty often had no internet at all. So how did all 23 branches of the Detroit Public Library have high speed internet? The answer to this question involves an elaborate system of federal subsidies and the commercialization of Merit Network, a "research and education network" governed by Michigan's public research universities. In this section I will discuss both sides of this equation, examining their conceptual and institutional history, along with interviews and observations that draw clear connections to the Detroit Public Library.

I walked into the main branch of the Detroit Public Library located in midtown, just a couple miles from downtown. The Library's main branch was well within the boundaries of redevelopment with active construction going on all around the area. I made my way to the Library's administrative offices. It was there I met Victor Ibegbu, the Assistant Director of Information Systems. Victor led me down a narrow hallway. We passed through a room that was full from wall to ceiling with stacks of old library computers. Sitting behind his desk, Victor explained how he was a hands on network administrator turned institutional administrator. One of Victor's earliest projects was to rebuild the Library's phone system using a voice over IP network, followed by installing Cisco's Meraki Wi-Fi system across all library branches. While describing the details of these system implementations, Victor seamlessly discussed the Library's mission of public service and its role in the city.

> *We're one of the few public services that still has a presence in most of the city. And when it comes to Internet access, for many of these neighborhoods we're one of the few options available, we're*

the closest thing to universal service.

By "universal service" Victor was referring to the idea of universally accessible internet. The history of universal service as a concept is often tied to the formation of the postal service as a notional monopoly with a universal service obligation (Dordick 1990). By the early twentieth century the term "universal service" was used to describe AT&T's monopolistic goal of building a national interconnected telephone network. This was particularly relevant during the 1920s, when small local networks were being taken over and connected with the AT&T network. As a national interconnected telephone network was achieved, the notion of universal service came to be understood in terms of cost, with the goal of making telephone service affordable for nearly everyone in the United States (Mueller 1993). The telephony model of universal service was formalized as a national objective with the passing of the Communications Act of 1934. It was believed, for both the postal service and the telephone network, that universal service would contribute to the creation of a common national identity while enabling economic opportunity (Turner 2015). Many of these same ideas would be repackaged in policy discussions regarding access to the internet and broadband networks.

E-rate: Building the Vanguard of a National Information Infrastructure

In September of 1993 President Clinton issued executive order 12864, which called for the Department of Commerce to form the National Information Infrastructure Advisory Council, or NIAC. NIAC would be tasked with developing recommendations for a "national information infrastructure" strategy. The executive order described the idea of a national information infrastructure as involving "the integration of hardware, software, and skills that will make it easy and affordable to connect people with each other, with computers, and with a vast array of

services and information resources." By 1995 NIAC released two reports, with the second report, *A Nation of Opportunity: Realizing the promise of the information superhighway,* arguing that universal service policies should include internet access. "Schools, libraries, and community centers would be the vanguard of this movement, giving citizens their first access to the Internet and other networks" (Carvin 2000).

The Telecommunications Act of 1996 involved the creation of the universal service fund, which included provisions for internet access at public libraries and schools. Under the authority of the Federal Communications Commission, or FCC, the universal service fund was divided into four subsidy programs: (1) the high cost program, (2) the rural health care program, (3) lifeline program, and (4) the school and libraries E-rate program (Schejter 2009). In 2017 the annual budget for the universal service fund was roughly 8.8 billion dollars and the E-rate program distributed 2.6 billion dollars to 104,722 schools and 11,475 libraries throughout the United States ("Universal Service Administrative Company, 2017 Annual Report" 2017). Among the more than eleven thousand libraries was the Detroit Public Library, which received $795,554.27 in E-rate funding to cover their annual costs of $882,838.08 ("E-Rate Recipient Details And Commitments" 2019). As subsidies, the universal service fund programs articulated a set of priorities that not only addressed the foundational economic issue of where and with whom networks should be established, but they intervened in the ongoing economic "tussle" of internet service costs (Clark et al. 2005). Relatively quickly the E-rate program helped public libraries establish internet connectivity.

In 1996 only 28 percent of public libraries offered internet access (Bertot and McClure 1998),

but by 2001 roughly 95 percent of public libraries offered internet (Kranich 2001). This measure of the E-rate's success reflected a notion of universal service that was largely informed by the history of telephony. The internet represented a critical shift in how information and content was used, differences that a telephony-inspired notion of universal service did not take into account. Thinking about these issues at the time was media and technology scholar Leah A. Lievrouw. Lievrouw argued that universal service policies were mainly focused on "system availability, not true access" (Lievrouw 2000). Notions of universal service, Lievrouw proposed, needed to move beyond the traditional focus on "conduits" or channels of communication, and start to consider the participatory dynamics of how content is created, accessed, and used (Lievrouw 2000). Lievrouw proposed a model of universal service that focused on "community information environments," involving notions of "content," individual "capacities to convert availability into accessibility," and various modes of "social participation" (Lievrouw 2000). Lievrouw's argument foreshadows the role of frontline mediators. While E-rate policies did not directly embrace this notion of information environments and social participation as Lievrouw suggests, the focus on networking public libraries had the unintended consequence of producing the role of frontline mediator. In an interesting twist, during the same year Lievrouw's paper on universal service was published, legislation was passed that tied to it a notion of "content" programming. But in contrast with Lievrouw's focus on positive liberties that information environments could enable, the legislation was concerned about safety and security, mandating "content filtering" requirements to any public library receiving E-rate funding. This proved to be a highly contentious issue.

Despite a chorus of E-rate enthusiasts, the establishment of the E-rate program was immediately

met with political pushback by republicans who either wanted to dismantle or restructure the program. Many public librarians were also conflicted about the E-rate program. Starting in the late 1990s, the American Library Association, or ALA, published a series of articles chronicling the conflicted and skeptical relationship librarians had with the E-rate program. On the most immediate level the complexity of E-rate application was a perennial source of frustration (Bolt and Albritton 1997; Schneider 1997, 1999; Lowe 2008). However during the first decade of the E-rate program the most contentious issue arose from subsequent legislation that mandated content filtering of the internet for those receiving E-rate funds. The Children's Internet Protection Act, or CIPA, from December of 2000, required all schools and libraries that received E-rate funding to use content filtering software to block online pornography and other "inappropriate" information. Senator John McCain, who sponsored the bill, is quoted saying "This approach provides a minimum floor for what must be blocked --- that material which is patently illegal --- while providing local authorities the broadest latitude to block other material like hate speech and racist material, how-to manuals on bomb making, and information on illegal drugs" ("News Fronts: Washington" 1999). While protecting children was uncontroversial, the more expansive idea of illegal information was contested. The content filtering software used at the time was rudimentary and limited in its abilities to sort content in any nuanced way. The republican congressman Jeffrey Pollock, who ran for public office supporting the federal mandate to filter internet access, changed his position after discovering his own website was blocked by filtering algorithms (Kranich 2001). The American Library Association challenged the Children's Internet Protection Act in court, arguing that filtering the internet was in direct conflict with first amendment rights, and thus unconstitutional. The Supreme Court upheld the law, arguing that filtering the internet to protect minors was acceptable so long as adults had

reasonable access to unfiltered internet (Corn-Revere 2003). Following this ruling the FCC updated the CIPA compliance requirements for public libraries as involving an unfiltered internet option for adult patrons. While the FCC has yet to perform audits related to CIPA compliance, CIPA-related litigation continued. In the *Bradburn et al. v. North Central Regional Library District* case from 2012, a library patron claimed the public library refused to unblock websites containing "legal" information about tobacco, art, and personal blogs. The court upheld the library's content filtering practices as justified under CIPA (Caldwell-Stone 2013). The debate surrounding federally-mandated internet filtering at public libraries remains unresolved, but the nature of the debate has changed. While concerns for first amendment rights persist, the role of social media, disinformation, and increased needs for cybersecurity have complicated the notion of there being an "unfiltered" internet.

Thus far, I have discussed the role of public librarians as frontline mediators and the political and conceptual history of the federal E-rate subsidy that helped network public libraries to the internet. I have argued that the role of frontline mediators is a byproduct or unintended consequence of the E-rate program. Next, I will discuss the history of Merit Network, the Detroit Public Library's internet service provider, and how their growth from being a small research and education network to being a statewide internet service provider for public sector institutions became a model championed by the Obama-era FCC.

Community Anchor Institutions & Research and Education Networks

In 2010 the FCC's *Connecting America: The National Broadband Plan* report argued for the building of regional broadband networks, or a "Unified Community Anchor Network," that

would connect regional anchor institutions such as public libraries and schools, hospitals, and colleges. This directly built upon the National Information Infrastructure Advisory Council's earlier argument that libraries and schools should be at the vanguard of a network infrastructure. But the 2010 report built upon the idea by explicitly identifying the role of "research and education" networks as being aligned with public service mission of anchor institutions (Commission and others 2010).

In the late 2000s the idea of "anchor institutions" gained purchase within the progressive community development discourse (Harkavy et al. 2009; Porter 2010). Anchor institutions included universities, hospitals, schools, libraries, and other public and nonprofit organizations that had a long-term commitment to their place and community. It was part of a progressive counterpoint to market drive notions of economic development (Webber and Karlstrom 2009). It was argued that, in contrast with the movement of capital, anchor institutions had a clear commitment to their place and communities and could operate as enablers of economic and community development (Porter 2010). The networking of anchor institutions was a logical extension of this vision, and as I have already mentioned. aligned with existing universal service policies established during the Clinton administration. The *Connecting America* report (2010) argued that the nation's Research and Education networks, or R&E networks, were in a strong position to provide internet service to regional community anchor institutions.

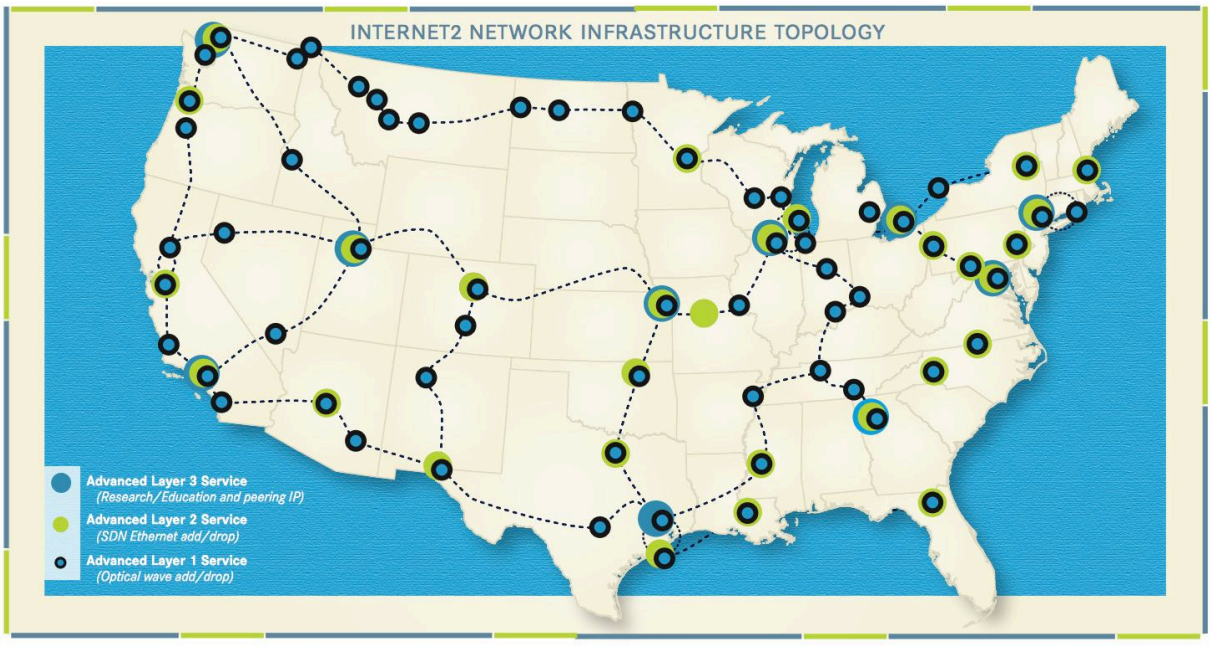
Most R&E Networks were governed or closely aligned with research universities, and many of them had historic ties to the early ARPANET, CSNET, and NSFNET (Leiner et al. 2009). Merit Network in Michigan was a flagship example of an R&E Network. Founded and governed by

Michigan's public research universities, Merit's history as a research project goes back to the 1960s and 70s. By the 1980s Merit was commissioned by the National Science Foundation to manage the NSFNet exchange points ("Merit History" 2018). Following the commercialization of the internet in the 1990s, most American R&E networks, including Merit, joined a national consortium known as *Internet2,* which had a clear mission of research, education, and public service (Teitelbaum 2001). By the mid to late 2000s, Merit Network, and a few other R&E networks affiliated with Internet2, begin to commercialize their operations and offer internet service to public sector and educational institutions ("Internet2 Community Anchor Program" 2017). The FCC identified these developments and championed the idea, arguing that the mission of R&E networks complemented the public service mission of anchor institutions (Commission and others 2010).

> *Expanding the R&E network model to other anchor institutions would offer tremendous benefits. … Facilitating collaboration on network design and how best to utilize applications to meet public needs could result in lower costs and a far more efficient and effective utilization of broadband … (page 154).*

Merit received a large federal stimulus grant to accelerate their expansion into a statewide network focused on serving public sector institutions ("Merit Network Receives Second Broadband Stimulus Award—REACH-3MC II" 2010). It was during this time that Merit became the Detroit Public Library's internet service provider. In the intervening years Merit positioned itself as a trusted internet and network services provider for Michigan's public sector. This included a Merit-managed firewall that tracks and manages all ingoing and outgoing network traffic on behalf of their clients, along with applied cybersecurity research that had clear connections to the interests of municipalities and Merit's public sector clients (Czyz et al. 2010;

Kallitsis, Michailidis, and Tout 2015; Kallitsis et al. 2016; Padin et al. 2017). On a national scale, by 2017 the Internet2 Community Anchor Program, or CAP, involved 44 R&E networks. Collectively the CAP program provided internet service and advanced applications to 87,796 schools, 5,336 public libraries, 2,594 vocational schools, colleges, and universities, and 1,900 health care organizations ("Internet2 Community Anchor Program" 2017). Similar to arguments made about the postal service and national interconnected telephone network, the *Connecting America* report argued that broadband initiatives like CAP, along with online government services, held the "potential to strengthen our democracy" (page 299). The report points to a heuristic of "civic engagement" that involves "new tools" that enable the public to engage with "information, their government, and one another" (Commission and others 2010).



internet2 map, 2018

Networked public services have enabled an inter-agency dynamic. As I discussed earlier, the concept of frontline mediators foregrounded the unintended consequences and emergent tussles that take shape between agencies, but there are also planned inter-agency partnerships. The story of Merit Network becoming a statewide service provider involved planned coordination and formalized partnerships between agencies operating at all levels of government. I have come to think of this dynamic as an *institutional topology,* where policies that dictate the flow of funds are bound to concepts of universal service that are themselves a byproduct of existing institutional structures and priorities. The institutional topology involves economic and trust tussles that reside along the edge of the network and align with institutional priorities, boundaries, and internal hierarchies. As the public sector case study in this dissertation, this chapter foregrounds how networked services operating in Detroit are part of a larger federated system of network infrastructures that operate at the state or regional scale, and that are themselves tied to national policies and concepts regarding the organizational structure of government and the interplay between agencies. The institutional topology is a way of describing how network services formalize institutional priorities and, in doing so, can involve emergent and planned inter-agency tussles.

5.4 Conclusion

The public library case study provides an empirical example of how federal and state policies, institutional priorities, and notions of public service have informed the design, configuration, and use of internet-related technologies. To evoke the multi-tussle framework, the implementation of

the E-rate program and the building out of Merit Network as a state-wide internet service provider represents the design-time aspects of the case study. The work of Detroit Public Library and Merit Network staff to access E-rate funds and provide internet service represents the configuration-time aspects of the case study. And finally, the push by state welfare agencies to direct their clients to public libraries to use online applications represents a run-time externalizing economic tussle. By closing their offices and directing their clients to public libraries, the welfare agencies externalized the true cost of service delivery, with the expectation that libraries would be able to absorb the costs. Thus, the role of 'frontline mediators' emerged from a set of economic and trust tussles. While the role of frontline mediators was in many ways anticipated in the abstract by scholars and policy researchers, from the perspective of the library staff the position was unplanned and thus reflects the adaptable quality of public libraries. For a more thorough multi-tussle analysis see chapter 7.

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Chapter 6: "Free WiFi" and Commerce

This chapter pulls from my fieldwork in the Highland Park area of Detroit, and centers on an ethnographic vignette involving a group of young men who had smartphones with no data plans. The young men would regularly gather outside Burger King and other local businesses offering "Free WiFi." One of the key findings in this chapter was an observable awareness of when and where free WiFi was available and the corresponding movement and social gathering that took place in relation to free WiFi, as well as how this was mirrored in the detailed behavioral data collected by the Cisco Meraki system, one of the most popular wireless systems on the market and the one used by Burger King to run their "Whopper WiFi" network. I argue that Meraki helped transform WiFi from amenity into an instrument for collecting, exchanging, and analyzing detailed behavioral data.

6.1 "Whopper WiFi"

While sitting on the porch with Chris late one evening, he suggested I talk with his daughter's friends because "…they know where all the free WiFi is." While his daughter's friends had phones many of them had no (or very limited) data plans and would actively seek out free WiFi. At the Detroit Public Library several librarians made similar comments. They explained that when the library closed, they turned off the WiFi. This meant library patrons using the WiFi on their phones would relocate to nearby fast food restaurants that offered WiFi all the time.

So when I first met Angel and his friends standing outside Burger King, socializing and checking their phones periodically, it did not come as a surprise. Angel was in his early 20s, had graduated from high school and worked part-time at a local liquor store, and was regularly studying at the Library in order to qualify for a vocational training program. He had a prepaid data plan on his

phone but no residential broadband internet. He used his prepaid data plan to get online at home, and then used free WiFi throughout the day whenever possible. Angel and his friends were an example of what Pew internet research describes as "phone-only" internet users ("Demographics of Mobile Device Ownership and Adoption in the United States | Pew Research Center" 2017). According to Pew, one of out of five adults in the United States is considered a "phone-only" internet user, meaning they have no residential broadband and rely almost exclusively on their phone to get online. They also tend to be young, non-white, and low-income. The phone-only internet user is part of a larger trend towards mobile use. In 2014 internet access through mobile devices surpassed laptop and desktop computers, and by extension mobile applications surpassed the web browser in terms of overall internet traffic (comScore 2014). In contrast with the desktop or "personal computer," the functionality of mobile phones is fundamentally tied to the network. Yet the concept of phone-only internet users does not account for variations in how connectivity is established. The key distinction being between mobile data and WiFi.

Mobile data networks and WiFi networks have distinct regulatory and commercial histories. While the spectrum used by mobile carriers was auctioned, the frequencies used for WiFi was deregulated and open for anyone to use. According to legal scholar Yochai Benkler, the auctioning of spectrum contributed to the proprietary model of wireless telephony, which aimed to "optimize a known set of services to known paying consumers." From the consumer perspective, the key distinction between WiFi and mobile data is that the latter is metered. Increasingly, mobile data plans involve "zero-rate" data options for applications and content providers that the mobile carrier has an established partnership with (Bates, Bavitz, and Hessekiel 2017). This means a data plan might include free or unlimited data for specific

applications. Benkler argues that the highly-controlled model of wireless telephony is in contrast with the "Internet model," which excluded control over the network (Benkler 2016). There were, however, companies in the early 1990s interested in metering residential internet usage, but it was initially not feasible, which created a cultural expectation that service costs for internet access would involve a flat fee for an extended, but nevertheless measured, period of time. With the introduction of WiFi standards by the late 1990s this flat service fee model enabled people to share their internet connection with little concern for cost. Within a decade, "Free WiFi" became a common and popular amenity offered in commercial and public spaces. The growth in smartphone use, along with the metering of mobile data plans, reinforced the desirable quality of free WiFi.

With everything I had already heard I expected to find people gathered at Burger King with the clear purpose of getting online, but this was not entirely the case. Inside, young families and teenagers were eating while a middle-aged man sat alone with his laptop. Outside, Angel and his friends had their BMX bikes, e-cigarettes, and their phones. They used their phones to play music, check social media, and message friends in other parts of the city. To play music they were using the YouTube mobile app to retrieve playlists of artists they liked; using the internet was a secondary concern. They were there to socialize with each other, and WiFi happened to be one of several factors that made this particular Burger King a regular gathering space for their friends. As Angel explained, "we have a friend who works inside and the WiFi is good."

WiFi was an implicit prerequisite for a location to be a social gathering place. Angel and his friends had a clear sense of where and when free WiFi was available, which included WiFi at the

public library branches, businesses operating in the area, and the North End WiFi network. “In this part of town, I know where all the WiFi is.” I followed Angel as we biked through the city. We passed by numerous fast food restaurants that had small groups of people gathered outside. We eventually stopped at a local laundromat that offered “Free WiFi,” television, a community bulletin board, and gym equipment. Outside the laundromat a group of older men were sitting on lawn chairs. A boom box played music that was being broadcast from a local radio station. A woman who lived down the street stood by the men talking about a shooting that had recently taken place in the neighborhood. I spotted several empty bullet shells on the grown and instinctively grabbed one and put it in my pocket.

The laundromat was an example of what Karen E. Fisher describes as an “information ground,” where people gather for an explicit purpose, in this case laundry, and through social interactions end up exchanging information that has little to do with the reason they are there, but is nevertheless relevant to their social network (Fisher and Julien 2009; Counts and Fisher 2010). Through radio, WiFi, and television, the laundromat and street corner was connected to several formal flows of information. Having used the laundromat’s WiFi many times, Angel’s phone automatically connected to the network. His phone buzzed with notifications from social media applications that he had specified to only use WiFi for updating. Angel sent a video and text message to a friend about a summer block party we eventually went to later that evening. Besides streaming videos from YouTube, Angel mostly used the photo sharing app Snapchat and the messaging app Kik to communicate with friends. Kik did not require a phone number to register an account, which made it a popular messaging application for those who might have a phone but not a stable mobile carrier. Angel had several direct message conversations going on

at once and nearly all of them were with friends living in Detroit. While the internet is often described as a global system, a large percentage of online communications are between people who inhabit the same local region. Additionally, the retrieval of online content often clusters around geographic regions, language, and cultural identities. There is a spatial dimension to networking that is implicit to how we understand and think about our sense of place and our ability to transmit and retrieve information.

Angel's movement through the city and awareness of where and when free WiFi was available reminded me of the late 1990s and early 2000s hacker game known as "war driving." WiFi was still an expensive novelty and war driving, or war cycling or walking, involved moving through the city in search of WiFi and in many cases "sniffing" wireless traffic (Berghel 2004). At the time most WiFi was unlocked and the Wired Equivalent Privacy algorithm, or WEP, was easily breakable (Curran and Smyth 2005). Following the 2003 release of the WiFi Protected Access protocol, or WPA, the radio frequency tide shifted and most WiFi networks began to be locked by default. On the one hand this was motivated by privacy and liability concerns, but it also aligned with the business interests of internet service providers. Security-minded advocates of open WiFi argued that the risks were overstated and that the proliferation of locked WiFi was primarily motivated by the economic interests of internet service providers (Schneier 2008). Thus the distinction between residential WiFi and "Free WiFi" as an amenity became more pronounced. As "Free WiFi" became a common offering in commercial and public spaces, it also became an instrument for collecting detailed behavioral data.

"Whopper WiFi" Terms of Service

A couple days after biking around town with Angel, I returned to the Burger King where we had met. I went inside and ordered some fries. Among the bright colors and the manic menu of food options was a sign advertising "Free Whopper WiFi." Press releases from 2014 described how digital technologies would be used to improve Burger King's customer service. This involved a Burger King mobile app, in-store kiosks and tablets, and Whopper WiFi available at nearly all of their 17,796 locations ("Burger King® Restaurants Launch WHOPPER® Wi-Fi" 2014). I sat down with my laptop and fries. The captive portal and login page advertised food, jobs at Burger King, and various ways to contribute social media content. Signing up for Whopper WiFi involved filling out an application that was akin to a short survey of personal information, including contact details. I opened the terms of service and privacy policy documents for Whopper WiFi and saved them as PDF documents on my laptop. While eating fries I read through the documents.

The Whopper WiFi terms of service required that anyone using the network be at least 13 years old, followed by a list of "prohibited content and activities," which included "impersonating" someone else's identity, or "harvesting" information from the network ("BURGER KING® Terms of Use" 2018). The terms of service made clear that any harvesting of information would be done by Burger King. The Whopper WiFi network, and the data it collected, was owned by Burger King, and Burger King's parent company Restaurant Brands Incorporated, or RBI. The Whopper WiFi privacy policy explained that the information they were collecting included: information people gave them while using their services, information collected about their use of services, and information they exchanged with third party "partner" companies, such as analytic

firms, advertising networks, franchisees, and large unnamed social media platforms ("BURGER KING® Privacy Policy" 2018). While RBI claimed to have "certain procedures" in place for protecting their data and systems, they made no guarantee that their services were secure or that they knew what 3rd parties might do with the data. RBI was running similar networks at almost all of their 25,000 restaurants, which included Popeyes and Tim Hortons. At the time there were 49 RBI restaurants operating in Detroit (twenty Burger Kings, ten Popeyes, and nineteen Tim Hortons). The Whopper WiFi network was built using Cisco's Meraki wireless system. Meraki was one of the most popular WiFi systems on the market for its ease of use and the wealth of behavioral data it generated. The terms of service and privacy policy described an asymmetric relationship, where RBI and Burger King were empowered to surveil the public and leverage the data they collected for any profitable or legal ends, with little to no accountability to the public they were surveilling. To understand the significance of Whopper WiFi one must understand the design and scale of Meraki. For this reason, in the following section I discuss the history and design of the Meraki wireless system.

6.2 Project Oxygen & Meraki

In 1991 the computer scientist and Massachusetts Institute of Technology professor, Michael L. Dertouzos, wrote an article in *Scientific American*. The article offered an "impressionistic glimpse" into the future of computing (Dertouzos 1991). Among the strikingly accurate predictions of services and applications that would eventually become commonplace, Dertouzos argued that information has economic value, but that we have difficulty evaluating or understanding its value. He described the value of information as a chain of sequences and

procedures that are in service of realizing "tangible goals" and "goods," and "less tangible human desires."

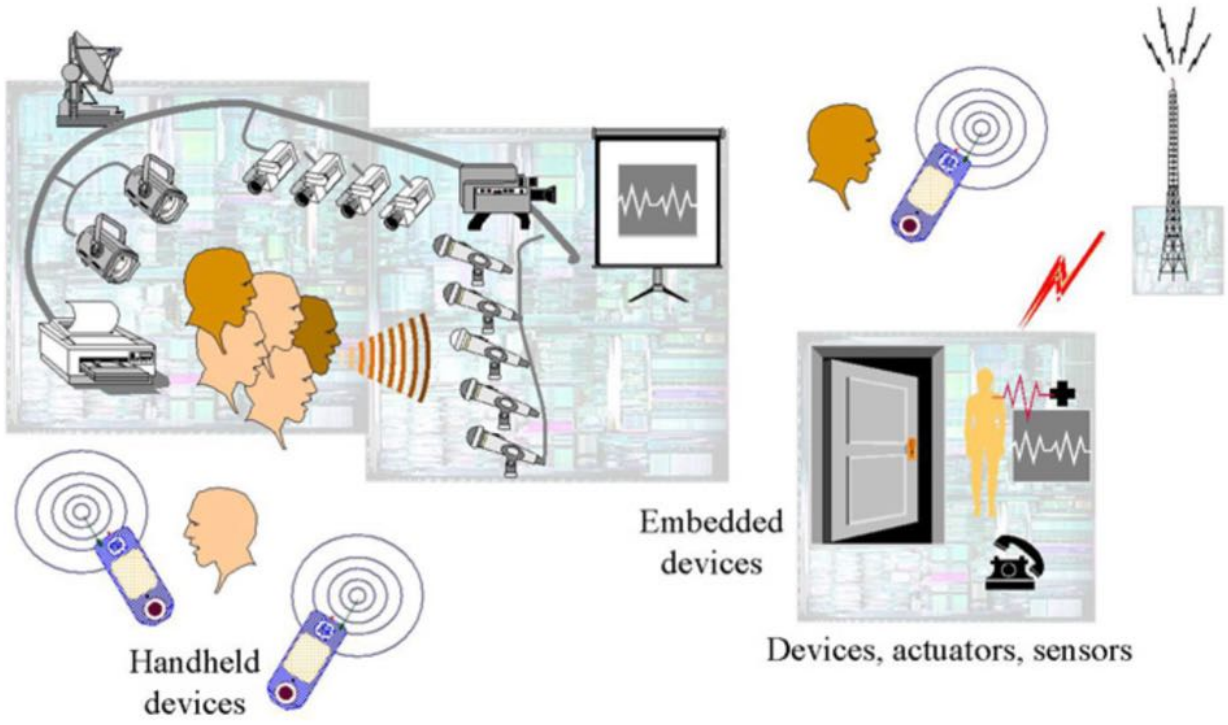
> *If information leads to goods through intermediate pieces of information, each one derived from the others though processing, then all the intermediate data and programs should also be somehow valued backward from the end results. (page 64)*

In a panel discussion with Bill Gates at the World Economic Forum in 1997, Dertouzos explained that the information marketplace would involve "buying, selling, or freely exchanging information and information work" (*Gates & Dertouzos World Economic Forum* 1997). Detrouzos was a classic liberal and techno-optimist who framed his vision of computing in terms of individual positive liberties. Dertouzos' notion of information marketplaces was part of a broader vision of "human-centered computing," where he argued that computers should serve "us," rather than "us" serving computers (Dertouzos and Foreword By-Gates 1998; Dertouzos and Foreword By-Berners-Lee 2002). As a computer scientist Dertouzos' focus was on engineering problem spaces and envisioning possible uses cases that he felt would make interactions with computers (i.e. office work) easier and more efficient. As director of the laboratory for computer science at MIT, Dertouzos was articulating a research agenda, funneling millions of dollars into the research projects that aligned with his vision.

Collaborative regions

In the late 1990s, with 30 million dollars in funding from DARPA and a short list of corporate sponsors, Dertouzos launched "Project Oxygen." The project abstract describes a future of voice-controlled mobile devices, and voice and gesture-controlled work environments with seamless

information storage and retrieval. The metaphor of oxygen was meant to evoke the idea of breathing and the possibility of networked computing becoming "intuitive," "pervasive," and "eternal" ("MIT Project Oxygen" n.d.). Demo videos from Project Oxygen show graduate students and researchers awkwardly acting out scenes from the future of white collar office work. In one scene a man walks into a building to find a mobile device on a table. He picks up the mobile device. The device scans his face. The man asks "show me my schedule." The computer replies, "Hello Ken, here is your schedule." A text representation of the man's schedule appears on the screen. The man asks "What is the office number for Jim Glass?" The computer replies, "The office number for Jim Glass is 603." The man asks "Where is he now?" The computer relies "Jim Glass is in Victor Zue's office, room 601a." A map of the building appears on the screen and the man walks out of frame while looking at the device in his hand. Project Oxygen envisioned a future of computer-mediated awareness. At the heart of Project Oxygen was a concept of "ad hoc" self-organizing wireless networking, that would facilitate "secure collaborative regions." Collaborative regions involve a "set of devices that have been instructed by their owners to trust each other to a specified degree," with "trust and authorization rules that specify what happens" within a region (Dertouzos 1999).



Project Oxygen diagram, http://oxygen.csail.mit.edu/Overview.html

Among the research that was funded by Project Oxygen was Roofnet, a wireless community network that, at its peak, covered six square miles of Cambridge (Chambers 2002; Aguayo et al. 2003). The project was led by graduate student Sanjit Biswas. At an industry conference some years later Biswas described how the Roofnet team designed self-configuring wireless nodes to make the installation process easier. They began handing out kits to volunteers who wanted to host a wireless node. There had been predefined engineering challenges, regarding mesh routing and traffic management, that had been solved in order to make the network functional. Once the network was implemented their research focused on analyzing network behavior. They noticed nodes were going dark for eight hours at a time, and then through follow up conversations with network participants realized people were turning off their routers when they went to bed at

night. As Biswas described it, "the network began to take on a life of its own…We began to see really interesting network phenomena" (Biswas 2012). With financial backing from Google, Biswas and the Roofnet team incorporated and launched Meraki.

"network-wide visibility and control"

During the process of commercializing the Meraki team decided to embrace a cloud-based architecture. This meant Meraki wireless nodes were designed to send an encrypted stream of network meta-data to the Meraki cloud, enabling Meraki to analyze and constrain network behavior. In this regard the Roofnet project's focus on analyzing network behavior informed the design of the Maraki architecture and "dashboard," the core Meraki product. The dashboard was designed to display data visualizations of network traffic, a map of wireless nodes, and a searchable database of individual devices connected to the network and their internet use. The cloud-based approach meant Meraki could scale while still maintaining a centralized point of control, enabling their clients to have "network-wide visibility and control" (Meraki 2011, 2018).

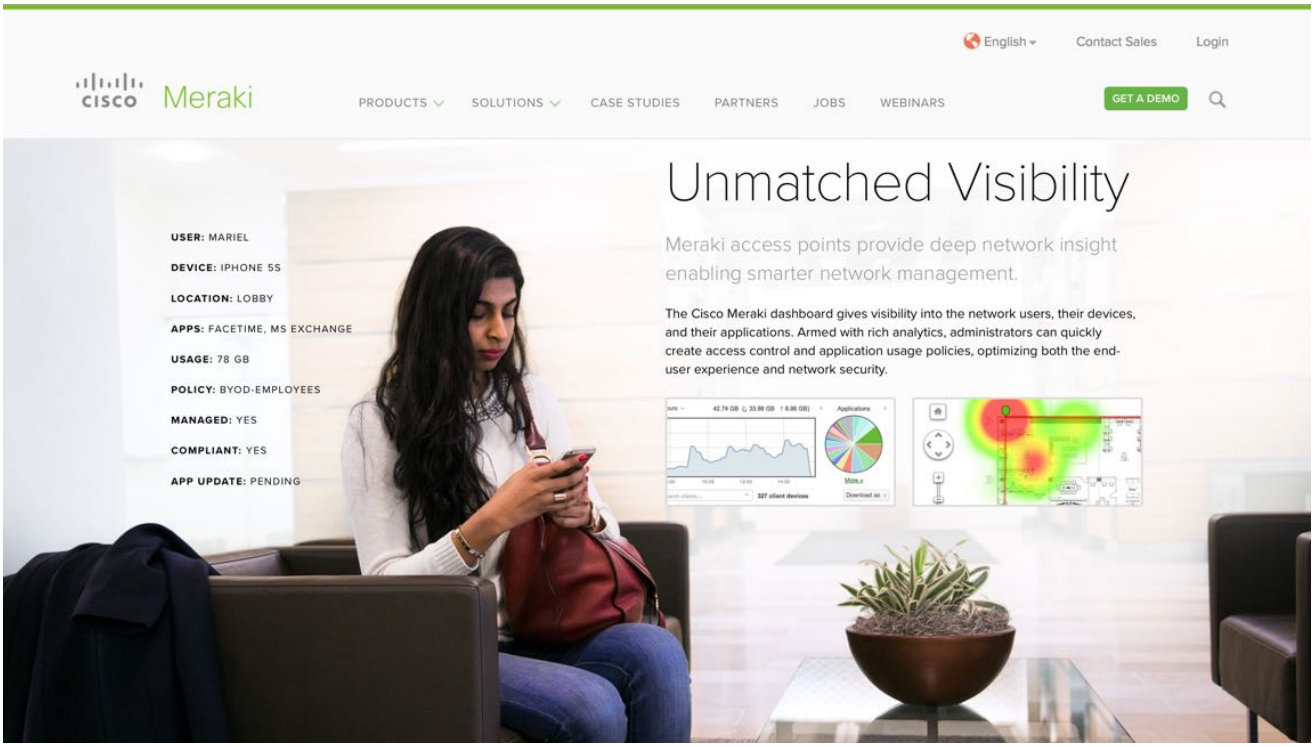
control and choice

The Meraki system was designed to be easy to use while simultaneously being flexible, modular, and customizable through detailed configurations. Through the Meraki dashboard or the application program interface, Meraki clients could make a series of choices regarding how their networks were used, the kinds of data their networks collected, and who had authority over particular networks and access to what data. In this regard the Meraki architecture was emblematic of David Clark's tussle-related design principle of "designing for choice." The connection is not coincidental, Clark was working at the same laboratory as Dertouzos, Project

Oxygen, and was developing his tussle-related argument around the same time as the Roofnet project. Clark argued that system designers should accommodate tussles by pushing key decision-making to the configuration and use of their systems (Clark et al. 2005). To achieve this, Clark suggested system designers should aspire to separate modular mechanisms from policy. With an understanding that mechanisms inherently constrain choice, Clark nevertheless argued that separating mechanisms from policy was a design strategy that would enable diverse outcomes. The Meraki architecture reflects this idea. Information policies became a key strategy for giving their clients choices and control over how their network operates.

information policies and network hierarchies

One of the key information policies within the Meraki system involved defining network hierarchies. "Organizational administrators" could define a hierarchical set of networks, including defined roles for administrators and the classified end-user devices, each with corresponding privileges. Within this hierarchical structure, administrators could opt in or out of various modular features and define policies for the features they use. This is particularly relevant for wide-area networks that operate across large organizations with many locations, such as thousands of fast food restaurants. The network hierarchies therefore have the potential to reinforce existing organizational structures. It is important to point out that the organizational administrators who define these structures are themselves embedded within the larger Meraki hierarchy. At the top of the Meraki hierarchy are the cloud administrators. Any changes to information policies or query of dashboard databases or network visualizations requires access to the Meraki cloud.



Screenshot of Cisco Meraki's website, 2018

visibility

While the Meraki architecture produces a sense of control by enabling their clients to define network hierarchies, roles, and permissions, the notion of "visibility" is used to account for the behavior of end-users. Within a few years of working with clients, the Meraki team realized they could leverage their data collection capacities to create new products and modular features that could address a wider range of client needs, such as security and marketing-related interests. Location analytics is one notable example. Designed with retail and restaurants in mind, but used more widely, location analytics was designed to track the physical location and movement of individual devices regardless of the person using the WiFi network to get online. By default, most mobile devices broadcast a signal every 15 seconds looking for WiFi. By tracking this

information Meraki has generated large amounts of detailed behavioral data.

Information marketplace

While Meraki's business model does not involve selling the data they collect, they have enabled a marketplace of data exchange for their clients. Using the Meraki application programming interface, developers and can pull Meraki data and use it as they wish. This capacity was streamlined with the Meraki Marketplace, which offers Meraki clients a catalogue of Cisco-approved 3rd party applications that easily install and will automatically access their network data. In the case of location analytics, 3rd party applications are regularly used to create comparative and predictive models of foot traffic and other related behaviors. These predictive models are then used to inform work schedules, becoming part of a social feedback dynamic. The extent to which behavioral data generated by Meraki networks feeds into the clear causal chains that eventually reach tangible goals, as Dertouzos imagined, is not entirely clear. What is clear is that there is a market for the sale and analysis of behavioral data, and that Meraki Marketplace is a clear example of "surveillance capitalism," where the surveillance of human behavior is used for "hidden commercial practices of extraction, prediction, and sale" (Zuboff 2015, 2018). Unlike well-known user facing services, like Facebook or Google, Meraki is not well known and yet it collects detailed behavioral data about people who are not even using the WiFi network to get online.

As I biked across town with Angel, he explained that the key characteristic of Free WiFi was the ability to get online and use the applications on his phone. Reflecting on Angel's movement through the city and his distinction between locked and free WiFi reminded me of the right to

roam movement, which emerged as a challenge to enclosed private lands and aims to keep all land open for walking. The analogy reflects earlier arguments made by advocates of open WiFi networks. But such metaphors and analogies fail to account for the notions of ownership and authority that are implicit to Dertouzos' vision of "collaborative regions" and the proprietary relations that are at play with Meraki networks. Dertouzos describes collaborative regions as involving trust and authorization rules that would be instructed by "owners." As Angel and his friends move through the city, stopping at different locations to use Free WiFi, they not only move through private property, they enter into a set of networked proprietary relations.

6.3 Conclusion

The commercial WiFi case study provides an empirical example of how research priorities, notions of convenience and exchange value, informed the design, configuration, and use of the Meraki wireless networking system. To evoke the multi-tussle framework, the research agenda of Project Oxygen followed by the research and design priorities of Roofnet and Meraki represent the design-time aspects of the case study. While the configuration-time aspects of the case study are tied to the implementation of the Whopper WiFi network. My observations of Angel and his friends using the Whopper WiFi network represent the run-time aspect of the case study. While the data collection practices associate with the Whopper WiFi network are legally framed as transactional, I argue they are better characterized as an extractive economic tussle, given the public's limited understanding of the data being collected about them and the limited legal protections regarding how such data is used. Furthermore, limited access to mobile data plans creates an economic incentive for low-income users to seek out 'Free' commercial WiFi. For a more comprehensive multi-tussle analysis see chapter 7.

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Chapter 7: Multi-Tussle: applying the tussle concept to qualitative research

Tussles are active, and involve a dynamic tension of values. Internet tussles express 'conflicting interests' and 'contention' through a combination of technical mechanisms and people, and the many economic, political, and cultural values that motivate their use of the internet. While some tussles are tied to large dramatic conflict, the vast majority of tussles are banal aspects of everyday life. In describing the concept of internet tussles, Clark presents an analytic model that involves three steps through time: design-time, configuration-time, and run-time. This is complimented by a second dimension that he refers to as tussle spaces, such as economics, trust, and openness (D. Clark et al. 2002; D. Clark et al. 2005). While 'time' and 'space' make for complementary dimensions I argue that the tussle 'spaces' are better understood as 'values.' They tend to overlap and change over time, particularly as systems are designed by one group of people and used by another. Furthermore, the delineation of design, configuration, and run-time, evokes a sequential notion of time that does not account for the ongoing, iterative, and concurrent dynamics that often characterize complex networked systems. Clark argues that design decisions can inform the 'shape' of future configuration and run-time tussles, but provides no examples of how this plays out. Instead, he examines one tussle at a time, presenting different cases for each point in the tussle model. In my adaptation of the tussle concept, I examine multiple tussles within the same case study. This involves using the analytic model of the tussle concept to organize, describe, and trace connections across design, configuration, and run-time.

In the tussle papers, Clark is interested in presenting an overview of the tussle concept, including the analytic model, the tussle related design principles, and the corresponding problem spaces for future design research. Writing for an intended audience of engineers and system designers,

Clark centers his description of tussles on technical mechanisms, while arguing that tussles cannot be reduced to technology alone. According to Clark, tussles involve both technical and non-technical elements. In making this point, Clark cites actor-network theory as a way of conceptualizing the relationship between technology and social and political forces (Latour 1990b; 1990a; Callon 1986). In his use of actor-network theory, Clark focuses on the notion of durability and the stability that comes with mature actor-networks. The assumption being that non-technical elements, such social arrangements and norms or institutional and political structures, will remain stable. This leads Clark to suggest that once the actor-networks that involve the internet stabilize, tussles will become a solvable design problem. While some internet tussles may have technical solutions, I argue that tussles should be understood as ongoing and dynamic, and fundamentally tied to the instability of markets, shifting cultural values, and political tensions. This involves an epistemological shift away from viewing tussles as a problem to be solved, to instead, understanding that conflicting values are inevitable and a key facet of networked political economies.

While Clark argues that there are non-technical factors that determine the nature of internet tussles, as a system designer, Clark cannot help but think of internet tussles as a problem to be solved. Clark simultaneously acknowledges the political, while continuing to hold onto a behaviorist notion that human behavior and values can be mechanized into the design of new systems. Thus, the tussle design principles articulate a set of values for the 'technical community,' and in doing so, act as a form of "boundary-work," aiming to fortify their professional authority and autonomy over the internet (Gieryn 1983). The values that the design principles layout, are largely aimed at protecting the 'openness' of the internet. By openness,

Clark refers to the ability to create and share new internet applications, and the ability for users to make choices and switch between applications and service providers. In his appeal for 'designing for choice' Clark indirectly evokes a classical liberal notion of individual agency, and the economic notion of market competition, yet these ideals are never explicitly drawn out. Instead they are described as the conditions for technical innovation and tantamount to Clark's notion of internet 'openness.'

In applying the tussle model to qualitative case studies I adapt the concept in several ways. While Clark focuses on technical mechanisms, I focus on the cultural values and ideas that animate the use and design of systems. Using the tussle concept to examine qualitative cases involves an awareness of multiple tussles, or what I refer to as *multi-tussle.* The *multi-tussle* approach involves using the tussle model as a way of organizing and describing observations and historic records. In this regard, the historic aspects of the case studies, involves tracing ideas, values, policies and technologies across design, configuration, and run-time. Thus, the tussle model becomes a more expansive framework for organizing and describing the differences found across heterogeneous networks. The goal of the multi-tussle approach is not to provide an all-encompassing theoretical synthesis, but rather a framework for describing and analyzing differences and similarities, unresolved tensions, the thesis and antithesis, found in actor-networks that involve a complex interplay between people, values, and digital technologies.

As actor-networks the organizational logic evades traditional dualities between macro and micro scales. Instead, I move through various scales within a given case, examining how specific embodied uses of digital technology are tied to macro issues ranging from geopolitics, national

telecommunication policies, to local institutional priorities. The multi-tussle approach uses the analytic model of the tussle concept to organize and describe the prioritization of concurrent tussles across design, configuration, and run-time. The delineation between design, configuration and run, is on some level an arbitrary heuristic distinction. In the subsequent analysis in this chapter, I identify the design, configuration, and run-time of each case, and within these distinctions I describe a prioritized set of values that correspond with tussles. The prioritization of concurrent tussles is central to the multi-tussle perspective. Not only do I trace how different values and tussles cascade across time, but how they compose a heterogeneous notion of networked contexts and circumstances.

To reiterate, internet tussles are not simply a problem to be solved, but rather an ongoing dynamic process, with no clear end. The multi-tussle approach adapts the analytic framework of the tussle concept towards an organizing the analysis of qualitative cases. This involves foregrounding multiple concurrent tussles and their prioritization across design, configuration, and run-time. Following this introduction, I apply the multi-tussle approach to analyze the three case studies. For each case I include an analytic table. In each table there are vertical columns designated for design-time, configuration-time, and run-time. Cutting across each of the columns are rows that correspond with specific questions. Starting with a brief 'description,' the questions include: Elements in the actor-network? Which actors are central to the case? How are values prioritized? Most of the analytic works happens with the last question, while the former questions help location and contextualize the case study and the distinctions I've made between design, configuration, and run-time. Within design, configuration, and run-time I identify a prioritized set values. Pulling from Clark description of the different types of tussles, I describe

them as either ‘trust,’ ‘economic,’ or ‘openness’ tussles. In many cases the designation is distinct, but in some cases they overlap and change over time. (For a more detailed explanation of the different types of tussles see chapter two.) With the columns side by side, one can see how the prioritization of values change or remain relatively stable as one moves across design, configuration, or run-time. Thus, the multi-tussle table acts as a distinct signature for each case, foregrounding comparative differences between the cases.

For instance, in the Community networking case, one can easily see that ‘trust’ and the securing of ‘on-the-ground communications’ was a top priority for the Commotion design team, but when one examines the configuration and run-time aspects of the case study that look place in Detroit, one finds that economic concerns become a clear top priority. In the commercial WiFi case study which traces the history and design of the Meraki wireless systems and the commercial implementation of ‘Whopper WiFi,’ one finds relatively consistent economic interests across design, configuration, and run-time. While Commotion frames trust and community privacy as tantamount to liberal democracy and freedom of assembly, Meraki approaches trust issues as matter of corporate liability on behalf of their customers. Thus, for Whopper WiFi trust is a matter of corporate interest and brand integrity. One of the critical ‘design’ distinction between Commotion and Meraki was their approach to cloud computing. While Commotion actively resisted relying on cloud services, Meraki actively embraced the economic advantages and scalability that cloud computing offered them as a firm. The distinction is tied to an ongoing set of economic and trusted relationships.

Compared to both the community and commercial WiFi case studies, the public library case is

the most heterogeneous when examining the design-time aspects of the case study. The design-time aspects of the public library case does not center on the design of a specific WiFi system, instead, I trace the conceptual and political history of 'universal service' that eventually helped bring internet access to nearly all public libraries in the U.S. including the Detroit public library (Dordick 1990; Mueller 1993; Hudson 2004). While the centerpiece of the public library chapter is the face-to-face computer assistance that librarians or 'frontline mediators' provide, in this chapter, I discuss additional details regarding the library's WiFi network and their use of Meraki. This foregrounds the tangible connections and comparative differences between the Public library and Burger King's WiFi networks. While both Burger King and the Detroit public library used Cisco Meraki for their wireless networks, institutional priorities and other differences found in their actor-networks, produce different outcomes. This is an example of how the tussle design principle of 'designing for choice' is tied to range of somewhat predictable, yet nevertheless diverse outcomes. In this regard, the design principle that Clark describes as part of his tussle argument provide a conceptual vocabulary for summarizing comparative differences between cases. While contrasting the Detroit public library's WiFi network with Whopper WiFi is illustrative of 'designing for choice,' contrasting both of these cases with Commotion and the North End WiFi network is an example of 'openness' and the capacity to choose between systems. As Clark warns, openness can be lost. Convenience and ease of use have been a driving force that led to the proliferation of relatively closed proprietary systems. As Clark argues, the lack of openness can shape markets. While there is an internal logic and quality to the organizing of communities and institutions, within this networked milieu such communities and institutions are increasingly caught within web of transactional, extractive, and externalizing exchanges of value. It is through such dynamics that priorities and values are encoded and performed into

networked systems.

"North End WiFi" and Community Networking in Detroit			
	Design-time	**Configuration-time**	**Run-time**
Description:	The institutional and political circumstances that facilitated the design of Commotion Wireless; the wireless system that would eventually be used by activists in Detroit.	The initial organizing and implementation of community networks in Detroit, using the Commotion wireless system.	The North End WiFi Network, hosted by Ulysses and other local community activists.
Elements in the actor-network?	Community Network Movement / Arab Spring / U.S. State Department / "Internet Freedom" Funding / Open Technology Institute / FOSS developers / Commotion Wireless / "internet in a suitcase" / Occupy Wall Street / Tunisia / NYC / Detroit / privacy & autonomy / community managed servers / end-to-end encryption	Open Technology Institute / State Department Funds / Commotion Wireless / Allied Media / Detroit Community Technology Project / digital divide / digital justice / critical pedagogy / community "anchor" institutions / Rocket Fiber ISP / Comcast / Sharing internet access /	Comcast & Rocket Fiber / Detroit Community Technology Project / Commotion Wireless / North End Neighborhood of Detroit / Ulysses Red Door Digital / North End WiFi / economic opportunity and development / homework / autonomy / community empowerment
Which actors are central to the case?	System designers behind Commotion Wireless, and the idea that digital privacy can be protected with new systems.	Detroit based internet activists, and the belief that digital technology can empower their communities.	Ulysses, Red Door digital, and those working with Ulysses to build the North End WiFi Network.
How are values prioritized?	(1) **Trust:** protecting digital privacy and resist surveillance. (2) **Openness:** Built upon and contributed to open source software. (3) **Economic:** Ease of use for building and maintaining a network. (3a) Local intranets could potentially reduce the need for upstream bandwidth. (3b) sharing paid for internet access with local community.	(1) **Economic:** Grant money from Open Technology Institute that funded the use of Commotion. (2) **Economic:** Sharing paid for internet access with local community. (2a) Training community members to build and maintain wireless networks. (2b) DCTP organizers negotiated an agreement with Rocket Fiber for reduced service costs for the community partners or anchor institutions that were hosting wireless networks.	(1) **Economic:** Transactional economic tussle between activists and commercial ISPs (2) **Economic:** Labor and material costs associated with building and maintaining a wireless network. (2a) **Trust/Economic:** criteria for where to build wireless and who receives residential service. (3) **Trust/Openness/Economic:** local administration of firewalls, and the criteria for acceptable and ideal network behavior.

7.1 Community Networking Case Study

In chapter 4, the community networking case study, I examine the aspirations and values of activists involved with building the North End WiFi network. I traced the backstory behind the development of the wireless system activists were using in Detroit. I discussed how political dynamics surrounding the Arab Spring motivated the U.S. State Department to fund the development of open source networking tools that would help protect the digital privacy of activists abroad. While there are clear differences when comparing the people and places involved in the design, configuration and run-time of the Commotion wireless toolkit and the North End WiFi network, the multi-tussle model foregrounds how these differences are expressed in the prioritization of values. As I previously mentioned the design team's primary concern was over trust and privacy of communication. In the context of Detroit, economic concerns were clearly the top priority for the configuration and run-time of wireless community networks.

7.1.1 Design-time

The design of Commotion wireless involved the Open Technology Institute (OTI) at the New America Foundation, a Washington D.C. based think tank. With funding from the U.S. State Department OTI facilitated the development of numerous open source projects that had the explicit goal of protecting digital privacy. The various projects were eventually packaged as "Commotion wireless." The central actors in design-time were the project organizers, developers and designers. In the prioritization of their design values, (1) *trust* was without question the top priority, this was followed by (2) *openness*, followed by (3) *economic* considerations. The

alignment between the State Department and OTI was based on their top priority of trust related matters, specifically the goal of protecting digital privacy.

Having observed the Arab Spring, the State Department was interested in helping foreign activists and journalists that they felt aligned with U.S. interests. OTI technologists were interested in a more general goal of developing technologies that could protect digital privacy and resist lawful or unlawful surveillance.

The technical documentation outlining the "Commotion architecture" includes an overview of "threat models," which includes among other things, a list of hypothetical "use cases," "users," "trust levels," system "priorities," and "assets" that might be of interest to an adversary ("Commotion Wireless" 2013). The imagined use cases included city wide public WiFi networks, community built networks, including small closed group networks, local disaster preparedness networks, popup networks by "infrastructural activists," and remote monitoring for environmental activism and research. Besides the environmental monitoring and city wide public WiFi network, the rest of the use cases have corresponding OTI funded empirical case studies. The Commotion trust levels reflects "access rights" that applications give users based on authentication. The trust levels includes a combination of both devices and corresponding users, from the end user and their client device, to wireless nodes and node administrators, to the network "dashboard" or Commotion server being run by a system administrator or "anchor" organization ("Commotion Wireless" 2013). In other words there is a hierarchical topology of trust. The Commotion server collects network information from available nodes and provides access to locally hosted applications. In contrast with Meraki, the Commotion nodes are

designed to enable a more distributed set of trusted relationships between nodes that are administered by others. This involves network administrators being able to account for malicious use of the network, and authenticate the identity of node administrators end users accordingly. While the Commotion team developed mechanisms to help with managing trust across the network, the successful use of such systems is nevertheless grounded on non-technical social factors regarding the trustworthiness of a person. As Clark describes, system designers regularly rely upon factors that remain external to the system. The documentation goes on to describe each use case in terms of priorities and "privacy needs," describing the top priority of community networks as "availability" followed by "confidentiality" ("Commotion Wireless" 2013). Given the motivating use case of the Arab Spring and politically motivated internet blackouts, the commotion threat models centered on the idea of there being a political adversary. This included both cyber and traditional on the ground security threats against dissents and journalists.

For OTI, developing Commotion as an open source project was not only a priority it was a practical necessity. Much of the Commotion system was built upon the open source work of others in the community networking movement. Commotion built upon the "OpenWrt" system, which acts as an operating system for routers and has strong connections with the community networking movement ("OpenWrt Wireless Freedom" 2019). The development of OpenWrt goes back to the early 2000s and was designed as alternative to the firmware that was typically shipped with off the shelf routers, giving developers and users the opportunity to customize the applications and use of their devices. The OpenWrt system reflects Clark's design principle of choice, and using the OpenWrt system within the Commotion project is an example of how open interfaces enabled the use of existing systems.

There are a few aspects to the economic concerns at play with the design of Commotion wireless. (3b) Wireless networks that connect with the broader internet will engage in run-time economic tussles over service costs of connecting to the broader internet. To some degree the focus on running locally hosted intranets engages with this issue by hypothetically (3a) reducing the need for upstream bandwidth. The more immediate economic concern for the Commotion design team was (3) the labor costs, or ease of use factor, associated with building and maintaining a wireless network, and deploying locally hosted applications. This latter design goal was never fully realized before the State department cut funding for the Commotion project. The differences in values regarding OTI interest in supporting the development and use of widely used privacy tools, versus the State Department's narrow support of specific foreign activists, eventually led to a conflict of interest. When the State department realized that the OTI was actively supporting domestic case study implementations of the Commotion they cut funding to the project.

7.1.2 Configuration & Run-time in Detroit

While trust and privacy were top design priorities for the development of Commotion, the poverty and fragmented internet coverage in Detroit meant economics was the top priority for community networking in Detroit. While Commotion's design focus on privacy aligned with the communitarian ideals of activists in Detroit, the economics of internet access were the primary drivers of action. Internet access and community networking was seen as a vehicle for both economic development and community empowerment. There is a noteworthy rhetorical shift from the notion of "user empowerment" that Clark references (D.D. Clark et al. 2005) to the

notion of "community empowerment" and "digital justice" that was used in describing the North End WiFi network and other community networks in Detroit (Gerety, Gunn, and Nucera 2015). The term user empowerment evokes an individualistic notion of agency and autonomy that echoes classical liberalism. "Community empowerment" by contrast, aligns with pragmatic and communitarian ideals that positive liberties and even creative agency can be found in the institutions and organizing of civil society (Gerety, Gunn, and Nucera 2015).

While the differences between design and configuration time are quite pronounced. The boundary between the North End WiFi network's configuration and run-time can be a bit ambiguous and fuzzy. The actor-networks involved with configuration and run-time are by definition two sides of the same network. There is however multiple ways one can delineate the boundary and differences between configuration and run-time. A narrow approach would focus exclusively on the implementation of the North End WiFi network. While a more expansive perspective would include a more heterogeneous account of the organizing, institutions, and funding that contributed to or facilitated the North End WiFi network. I have opted for the latter approach.

7.1.3 Configuration-time

Within the more expanded notion of configuration time we locate the organizing of the Detroit Community Technology Project (DCTP), including the coalition building and grant writing that culminated in OTI funding DCTP implements of Commotion in Detroit, and the subsequent organizing and curriculum design that took place. In contrast with the design-time, with the configuration and run-time taking place in Detroit economic concerns become a top priority. In

the case of this particular configuration time, the list of prioritized economic considerations, represent less of a static snapshot in time and more of a sequence of concurrent yet shifting priorities over time. That is to say, the (1) choice to use Commotion was incentive by grant funding, and the desire to build wireless community networks was motivated by a belief that (2) internet access contributes to economic opportunity, (2a) that training community members to build and maintain wireless networks would contribute to a more dynamic digital ecosystem and thus greater economic opportunity. And finally the last point, (2b) is about negations over the ongoing service costs for internet access.

The choice to use Commotion wireless in the first place was largely tied to the available grant funding that came with it. OTI offered DCTP funding to build a case study community network using the Commotion system. Prior to the formalized organizing of DCTP, local activists that were building community networks were using the Open Mesh wireless system, which has a sizable community of associated developers and network administrators, and ample technical documentation for troubleshooting problems. The choice to use Commotion, among other interpersonal factors, contributed to some early community network activists limiting their involvement with DCTP.

Sharing paid for internet access with the local community. Independent of which wireless system they would end up using, internet access was seen as providing economic opportunity. (2a) And training local community members with the skills needed to build and maintain wireless networks was also described as contributing to economic opportunity. Both represent a motivating logic that aligns with the broader goal of economic and community development.

This is also where we begin to encounter narrative capitalism, the storytelling involved in building coalitions, and accessing and developing community controlled resources.

(2b) Several years into the DCTP community networking efforts, DCTP organizers negotiated a discounted rate with the new commercial internet service provider Rocket Fiber. The negotiations were done on behalf of community "anchor" organizations and individuals that were hosting community networks and willing to their internet connection (Gerety, Gunn, and Nucera 2015). Community activists we thus part of a set of relationships that mediate run-time economic tussles.

7.1.4 Run-time

Examining the North End WiFi Network, we understand the network from the perspective of the network activists and "anchor" organization hosting the network, specifically Ulysses and his design studio Red Door Digital. While there are idiosyncratic aspects to the Ulysses character, Ulysses also stands in as an example of a community activists turned network administrator. And his design studio an example of a local "anchor" organization. It is from the perspective of the "anchor" organization or community activist that is hosting the network that we come to understand the run-time prioritization of values. As an overlapping extension of the configuration-time, economic concerns remain a top run-time priority. (1) Community activists or anchor organization that host community networks mediate the transactional economic tussle between the local community of "end users" and the commercial internet service providers operating in Detroit. In other words, individuals and organizations that host community networks not only (2) take on the work involved in building and maintaining wireless networks, they (1)

pay for internet access and then share their connection with the local community. Beyond this primary transactional economic tussle there are several secondary tussles regarding the building and administration of wireless networks. As I mentioned above, by hosting and building wireless networks local activists (2) take on the material and labor costs associated with the wireless network. Besides costs, this includes (2a) economic and trust criteria for where to build the wireless network and for whom residential internet is provided. It also includes the issues (2b) administering a firewall, and the corresponding trust, openness and economic issues that come with it.

Community networks in Detroit were dependent upon commercial internet service providers for upstream connectivity with the broader internet. Besides building wireless networks that extend the coverage area, activists and organizations that host a community network tend to purchase internet access from a commercial ISP and then share their connectivity with the local community. On the one hand we can understand this as a transactional economic tussle between the activist or organization purchasing internet access and the internet service provider, at the same time, by providing internet access to the local community these activists and organizations mediate the economic tussle on behalf of their local community. This is an example of how tussles can involve mediated relationships, composed of three or more parties. This is a recurring dynamic found across the three cases.

In the case of the North End WiFi network, we find additional concurrent economic issues. While Ulysses and the Red Door Digital design studio purchase internet access from Comcast, they were looking to pay Rocket Fiber to extend their fiber network to the Red Door building.

Thus giving Ulysses and the North End WiFi network access to greater bandwidth and the DCTP negotiated discounted rates. In the context of Detroit, the arrival of Rocket Fiber created the rare experience of competition between commercial internet service providers.

Besides the purchase of internet service, activists involved in community networking generally take on the labor and material costs associated with building and maintaining a wireless network. The North End WiFi network was financed and built with a combination of volunteerism and limited collection of grants. Ulysses had pulled funds from a public art grant he was working on to extend the North End WiFi network in his immediate area. (2a) Inherent to the building of wireless networks is the issue of where to build wireless nodes and for whom residential internet access is provided. While there are material and environmental constraints that inform decision making, there are also implicit or explicit criterial how networks are built. This is briefly discussed in the Vice documentary about wireless networking, where the local church leader discusses the quasi-formal criteria for receiving residential internet service. The criteria was essentially a combination of the physical geography and means testing. Apply a narrow definition of configuration and run-time these kinds of decisions might be described as taking place during the configuration-time. But such a distinction is only helpful insofar as it highlight differences in social actors and their decision making. In practice, configuration, building, and maintenance of wireless networks generally overlaps with ongoing run-time issues. A similar point could be made about the administration of firewalls.

Clark describes the use of firewalls as a trust issue, and a byproduct of the growth in internet use and the heterogeneous nature of the many actor-networks that came to use the internet. Firewalls

became a practical tool for managing network security. Firewalls are in many ways the most routine of the trust related issues or mechanisms that Clark describes, and therefore emblematic of the historic shift away from the "transparent" idealized internet that was used by a rather homogenous group of trusted colleagues. In the community networking case study, Ulysses stressed the idea of a "neighborhood firewall," describing it as instrumental in mediating a set of economic tussles. He argument is many ways simply resembles the business models of commercial providers of "Free WiFi," to act as a trusted middle man that oversees network traffic, devising ways to monetize network behavior. In other words, the administration of firewalls foregrounds the complicated relationship between network administrators and end-users. There are economic factors, as Ulysses described, and there are trust issues regarding "appropriate" network behavior and how or who makes such decisions. In the context of community networks in Detroit, this remains a tacit but nevertheless potentially thorny issue. The idea of there being an open or transparent internet acts as a false baseline from which such issues are discussed. Instead we should understand the issue values as playing an vital yet contested role across heterogeneous networks.

"Frontline Mediators," Internet Access at the Detroit Public Library			
	Design-time	**Configuration-time**	**Run-time**
Description:	The conceptual and political history that brought internet to 96% of public libraries in the United States, including the Detroit Public Library.	The implementation of internet access at the Detroit Public Library (DPL).	Internet access at the Parkman Branch of the Detroit Public Library, and the role of "Frontline mediators."
Elements in the actor-network?	Universal Service / Fund / E-rate / subsidy / Merit Network / "anchor" institutions / Detroit Public Library / Parkman Branch / e-government / services / welfare / utilities / CHAMPS	DPL Director of Information Technology / digital divide / universal service / online E-rate application / Merit Network / Cisco Meraki / never looks at Meraki analytics / online databases / subscriptions	Merit / Meraki / Parkman branch / desktop computers / online welfare applications / Frontline mediators / welfare application booklets / (il)literacy / poverty / anxiety / face-to-face / human mediated computer / interaction
Which actors are central to the case?	The E-rate federal subsidy, and the knowledge that anyone can get online at public libraries in the United States.	DPL Director of information technology, DPL IT staff, and their belief that internet access at DPL can help bridge Detroit's digital divide.	Frontline mediators and their face-to-face interaction with library customers, supporting their use of online welfare applications.
How are values prioritized?	(1) **Economic:** FCC's universal service fund - E-rate subsidy for telecom & internet at public libraries & schools in the U.S. (2) **Openness:** The E-rate program emerged from a conceptual and policy discourse that championed a vague notion of openness. Within a few years E-rate compliance required schools and libraries to "filter" the internet in the name of child safety. (3) **Economic**: Building of Merit Network	(1) **Economic/Trust:** E-rate involves a complicated year-round online application, that acts as a means-testing system for the school or library applying for funds. (1a) **Economic:** Merit & Meraki funded by E-rate. (2) **Economic:** Merit runs all the library's network traffic through a single gateway enabling the library to use one subscription for online services across all of their locations. (2a) **Trust:** Merit runs a network-wide firewall. (3) **Trust:** Library runs standard Meraki data collection, but they "never look at it." (3a) Meraki offers content filtering so libraries are E-rate compliant.	(1) **Economic:** With the closure of welfare offices, customers were directed to the public library to use online applications. Externalizing some of the cost of service delivery, by "dumping" their costumers onto the library. (1a) **Economic/Trust:** "frontline mediators" mediate a set of economic and trust tussles between their customers and numerous government applications. (2) **Economic/Trust:** The Detroit Public Library's WiFi network is on only during open hours of the day.

7.2 Public Library Case Study

In the public library case study I examine the work of neighborhood librarians, or "frontline mediators," who actively support internet access. While the public library's WiFi and desktop computers are used for a variety of purposes, the most common use case involves three online welfare applications. As 'frontline mediators' the librarians document and facilitate the use of these online welfare applications. The role of frontline mediators is illustrative of how tussles can often involve numerous mediated relationships. There are three central actors in this run-time multi-tussle, the librarians, the library patrons, and the online welfare applications. Their tussles are tied to economic and trust related issues. The library patrons, or clients, provide personal information in exchange for much needed resources. In this regard the client – welfare application relationship involves a transactional economic tussle. As part of this relationship, one assumes that the data being collected will not be misused. But what constitutes misuse is ambiguous, and the actually ways welfare data has been used is opaque at best. In context of library and the face-to-face facilitated use of the internet, there is the additional trusted relationship with the librarians who regularly help handle sensitive information on behalf of their clients.

The configuration aspects of the case involve network administrators working at the library, and their dependence on Merit Network, Cisco Meraki, and the Federal Communications Commission's E-rate subsidy. These are the central actors that enable internet access at the Detroit public library. From there, the design-time aspects of the case study examine the conceptual and political history that led to the formation of the E-rate subsidy that brought

internet access to roughly 96% of public libraries in the United States, including the Detroit Public library (Lowe 2008; Hudson 2004). Rather than tracing the design, configuration, and use of a specific system, like I do in the other two case studies, this case study focuses on how the notion of public and universal service are formalized into policy and the design of information systems and services, which in turn, informed the work of public librarians. The traversal of design, configuration, and run-time, illustrates how tussles accumulate and build upon each other. Even if the tussles are not directly tied to the design of a single system, they accumulate and inform decision making. Thus, the 'frontline mediator' was not planned, but rather emerged as a byproduct of the E-rate program, subsequent state policies to move welfare applications online, and the needs of local Detroit communities. The role of frontline mediators, and by that I mean their attributes and qualities are at simultaneously particular to their institutional and historic position, and emblematic of a more generalizable dynamic of how relationships are bound up in multiple tussles.

7.2.1 Design-time

Within the *configuration* and *run-time* of the public library case study, one finds the recurring expectation that public libraries provide access to the internet. Thus, the *design-time* aspects of the case study examine the origins of this expectation. Starting with the notion of universal service, we uncover a political and conceptual history that eventually led to the passing of the Telecommunications Act of 1996 and the formation of the Federal Communication's Universal Service Fund (Federal Communications Commission 1996). One of several universal service fund programs, the E-rate subsidy was designed to fund internet access at public libraries and schools across the United States. By 1999 roughly 96% of public libraries offered public internet

access. The E-rate program formalized a vision that public libraries and schools would act as the popular vanguard for internet access. With many universities already online, it was imagined that most people would encounter and use the internet for the first time at the public library. Policy reports from the time argued that people would eventually come to the library to use online government services (Billington 1996; Kahin 1995).

I had my first encounter with the internet at the local public library, shortly thereafter I had extended experiences 'surfing the web' at my public middle school, followed by my father's graphic design studio, and eventually at home. While middle class parents eagerly purchased internet access for their children, media coverage about the internet paid considerable attention to parental anxiety regarding the safety of their children. It was during this time that republicans spearheaded legislation that required libraries and schools to 'filter' the internet as part of their E-rate compliance (Caldwell-Stone 2013). Following the E-rate's primary function as an economic intervention, aimed at subsidizing internet access for public libraries, the E-rate compliance requirements not only informed the design of content filtering systems that would go on to be used outside of libraries, they foregrounded the legality of information and networked behavior, while simultaneously assuming the internet to be a neutral and unfiltered system to begin with. Thus, key design-time tussles were articulated through legislation and then subsequently formalized in the design and delivery of services.

With the support of the E-rate program Merit Network would go on to become a statewide Research and Education (R&E) network, aimed at supporting Michigan's public sector and education institutions. During the Obama administration, FCC policy reports identified Merit as

a model that could be replicated across the country. It was argued that R&E networks could expand beyond their universities to build regional "community anchor networks" with organizations like as public libraries and schools, and that their operational costs would be covered by the E-rate program (Commission and others 2010). Merit illustrated how research and education networks could scale, and apply cyber security research to public sector services. Under the Obama administration, it was argued that the mission and values of R&E networks were more closely aligned with the mission of public service and the daily work of anchor organizations. Implicit to their argument, were the economic and trust tussles that constitute the customer – internet service provider relationship. This includes the basic transactional economic tussle that the E-rate program actively intervened in, but it also included the trust issues regarding network security, and the authority to administer network-wide and client specific firewalls and network traffic management. The historic developments that I describe as the 'design-time' aspects of this case study are embedded within iterative cycles of design, configuration, use, and redesign. The actors involved with the design-time aspects of this case study are beyond the institutional boundary of the Detroit public library, referring to institutions and systems that are outside their direct control but nevertheless instrumental in the library's ability to offer internet access to the general public. The configuration aspects of this case study, which I discuss below, involve library staff, the various systems and services they interface with and the decision making that is required of them.

7.2.2 Configuration-time

If design-time focuses on the political and conceptual history that led to nearly all U.S. public libraries having internet access, then configuration-time involves the embodied actor-networks

that supports internet access at the Detroit Public Library, this includes the library's internet service provider Merit Network, the E-rate subsidy application and funding, and library staff that interface between the two. There are other actors and associations, but Merit, E-rate, and the library staff are at the center of the configuration aspects of the case study. Given the relationship between configuration and run-time, they also play an implicit yet nevertheless key role in the run-time aspects of the case study.

Merit network is a non-profit internet service provider that acts as statewide network serving public sector and educational institutions. When examining the Merit network - Detroit public library relationship, one finds a several concurrent tussles. There is the (1a) transactional economic tussle regarding internet service delivery. Largely funded by the E-rate subsidy, there is also the (1) online E-rate application which is an example of an economic and trust tussle between the Detroit public library and the E-rate program. Examining the Detroit public library and Merit relationship we also find the (2a) trust and openness tussle surrounding the administration of library specific and Merit-wide firewalls. On the one hand, the Detroit public library trusts Merit and outsources much of its cyber security to Merit. While Merit holds key administrative authority over the Detroit public library's network, the library welcomes this authority in exchange for the assurance that their systems will be kept secure from malicious third party actors. This relationship and management of the network, also ties into numerous secondary (2) transactional economic tussles between the Detroit public library and online databases and service providers that charge subscription fees.

While examining key service providers and systems that enable the Detroit public library to offer

public internet, one also finds the presence of Cisco's Meraki. A commercial wireless system, I discuss Meraki at length in the commercial WiFi case study in chapter six. The design of Meraki involves the collection of detailed behavioral data. (3) According to the library's director of information technology, their wireless network was collecting a wide range of behavioral data but the library made a point of never looking at it. I will discuss this point again towards the end of this chapter, but when one compares this to commercial uses of Meraki where behavioral data is regularly examined and analyzed in pursuit of maximizing profits, we find a heterogonous landscape, the nuances of which are lost when data collection is theorized in the abstract as an expression of economic and political power.

Additionally, (3a) within the Meraki system one finds numerous mechanisms for content filtering that were designed with public libraries and schools in mind, directly in response to the E-rate's filtering requirements. According to the library's director of information technology, the Detroit public library does not use Meraki content filtering. Despite these systems being designed with public libraries and schools in mind, they have been used by clients across all sectors, particularly public facing retail spaces.

To reiterate, the three way economic tussle between the E-rate subsidies, Detroit library staff, and Merit network is squarely at the center of the configuration aspects of the case study. From there one finds a series of trust and openness tussles regarding the administration of network firewalls and cyber security, and economic tussles regarding the routing of network traffic and secondary subscription services the library pays for. And finally, I discussed the presence of the Meraki wireless system and the tacit trust issues surrounding the collection of behavioral data

and the potential for content filtering.

In the next section, I discuss the run-time aspects of the case study and in doing so, pivot to the services and tussles that depend upon the public library offering internet access. In the case of the Parkman branch of the Detroit public library, the most commonly used services included state welfare applications and a proof of hardship application for the local utility company. Confident that their clients could get online at the public library, the state welfare agencies closed their brick and mortar offices and directed their clients to use an online application at their local public library. While this move towards online applications is anticipated in federal and state policy reports, and even some academic research, from the perspective of the librarians working at the Detroit public library it was unexpected. They quickly adapted to support the emerging information needs of their clients.

7.2.3 Run-time

From the multi-tussles approach, run-time and configuration-time tussles are often two sides of the same issue. One could describe the various trust and economic tussles discussed in the configuration section as simultaneously operating within run-time. But for the run-time aspects of this case study, I focus on the work of librarians from the Parkman branch of the Detroit public library. I discuss how librarians from the neighborhood branches act as 'frontline mediators,' supporting the use of online welfare applications. The librarians repeatedly described the origin story or emergence of the 'frontline mediator' role as being tied to the closure of local brick and mortar welfare offices, and the redirection of welfare clients to the public library to use

online applications. This process was an example of an (1) externalizing economic tussle, where system affordances and institutional arrangements enabled state agencies to offload the costs service delivery onto public libraries. This meant some neighborhood librarians began dedicating most of their working hours to facilitating the use of online welfare applications. Thus the role of 'frontline mediator' emerged. When examining the work of frontline mediators (2) one finds a multi-tussle, involving a set of mediated relationships: the welfare agency – librarian, welfare agency – client, and client – librarian connections. As part of this web of connections, we can also describe the role of frontline mediators as being at the center of a three way tussle, facilitating the interaction between their clients and the welfare applications they are using. There were several attributes to the work performed by frontline mediators, I describe these as falling within a vin diagram of social, cognitive, and formal attributes. While the role of frontline mediators is informed by the foundational (1) economic tussle between the welfare agencies and library, the *formal attributes* of their work are most directly tied to the library – welfare agency connection. By contrast the *social* and *cognitive* attributes of their work reside along the client – librarian connection. The tussle between the welfare agencies and their clients is both economic and trust related. There is a transactional economic logic, where clients submit a wide range of personal and somewhat sensitive information and in exchange they receive access to much needed resources. Following the transaction, there is an implicit trust issue over how the collected information will be used. Since frontline mediators facilitate this exchange of information, handling social security numbers and other sensitive information, the interactions with their clients involves similar issues of trust over how they handle this information. While the librarians that performed this work, were somewhat frustrated with the welfare agencies and utility company that directed their clients to the library for assistance, the work of frontline

mediators illustrates the adaptability of public libraries and the value that comes from planning for concurrent needs and facilitating interconnected services.

Beyond the immediate scope of the frontline mediator role, there was also a secondary run-time tussle over the availability of the library's WiFi network. To avoid loitering, it was library policy to turn the WiFi network off when the library closed. While this tussle is not central to the analysis of frontline mediators it directly ties the library case study with the commercial WiFi case study, since turning the wireless network off motivated users to relocate to nearby fast food restaurants and laundromats that offered 'Free WiFi' all the time.

To reiterate, the central run-time tussles includes the foundational externalizing economic tussle between welfare agencies and the Detroit public library. As the librarians described it, the use of online applications enabled the agencies to 'dump' their clients onto the library. Subsequently, the role of frontline mediators involves numerous economic and trust related tussles between the welfare agencies, the librarians, and their clients. Thus the frontline mediator plays a central role in the run-time aspects of the case study. This is however a noteworthy, secondary tussle over the availability of the WiFi which in very tangible terms bridges the library case study with the commercial WiFi case study I discuss in the following section.

Whopper WiFi: Commercial "Free WiFi"			
	Design-time	**Configuration-time**	**Run-time**
Description:	The research project Rooftnet commercializes and incorporates as Meraki. Meraki becomes the industry leader in commercial WiFi systems.	Technical configuration and legal terms of service for "Whopper" WiFi. Whopper WiFi was built using Meraki.	"Free WiFi" available 24/7 at Burger King locations in Detroit. Young adults with smartphones but no data plans rely on Whopper WiFi to use their favorite mobile apps.
Elements in the actor-network?	Project Oxygen / DARPA / Michael L. Dertouzos / the economic value of information / human-centered computing / Roofnet / network behavior & visibility / incorporated as Meraki / centralized "cloud" architecture / hierarchical administrative authority / behavioral analytics / data market place	Meraki / Restaurant Brands International (RBI) / Burger King / wide-area network / 17000+ locations / about 20 locations in Detroit / data collection / behavioral analytics / sharing data with 3rd party vendors & partner companies / Comcast	Comcast / Meraki / Burger King / "Free" Whopper WiFi / Data collection / analysis / sharing / legal terms of service / privacy policy / social gathering space / Angel / mobile phones / no data plans / "phone-only" internet users / messaging friends / streaming music
Which actors are central to the case?	Meraki system designers, and the visualizing of network behavior.	Whopper WiFi terms of service, and Burger King privacy policy. Collect as much data as possible, and minimize corporate liability.	Angel and his friends show have smartphones but no (or very limited) data plans, and gather outside Burger King to use the "Free" WiFi. Meraki cloud, and its data collection, and the legal terms of service for Whopper WiFi.
How are values prioritized?	(1) **Economic:** Ease of use, for installing and configuring nodes. (1a) **Trust:** visualizing network behavior. (2) **Economic / Trust:** cloud based architecture meant Meraki clients were dependent upon Meraki servers. Creating both an economic and trust based relationship. (3) **Openness:** Roofnet built upon and contributed to numerous open source projects that were affiliated with the community networking movement.	(1) **Economic/Trust:** Using the Meraki cloud, Whopper WiFi is configured to collect as much data as possible, across its 17,000+ locations. (1a) **Economic/Trust:** Legal documents (terms of service, privacy policy) aim to minimize corporate liability, while enabling Burger King to maximize the market value of the data Whopper WiFi collects. (1b) This involves sharing data with 3rd party vendors and partner companies.	(1) **Economic:** With no or very limited data plans, Angel and his friends are motivated to find and use open WiFi. The Whopper WiFi network offers "free" internet access 24/7. (1a) **Economic:** The data collection that takes place with Whopper WiFi can either be framed as a transactional exchange (we give you free internet access, in exchange for surveilling you), or it can be framed as an asymmetric extraction of value. (2) **Trust:** Moving between networks, there is a tacit yet nevertheless consistent trust related tussle between those that administer and define network policies and the users that use and depend these network.

7.3 Commercial "Free WiFi" Case Study

The Free WiFi case study starts with observation from Burger King, where I met a group of young men that largely depend on 'Whopper WiFi' and other 'Free WiFi' networks for their internet connectivity. Compared with the other cases, this is the first time we encounter the so called 'end user.' Most of the young men owned a smartphone, but had no, or very limited, data plans. Joining them on a bike ride across town to other businesses offering free WiFi, I discussed their awareness of when and where free WiFi was available, their physical movement between these locations, and the idea that free WiFi was one of several factors that contributed to a location becoming a social gathering spot. In the latter half of the chapter I examine the backstory behind the design of Meraki, one of the most common commercial WiFi systems on the market, and the system that was used for the Whopper WiFi network. From its inception as an academic research project, to its eventual market dominance, the Meraki team championed the notion of network 'visibility,' eventually maturing into a system that could facilitate the widespread collection of detailed behavioral data and the creation of a market place for sharing and analyzing such data. Like all of the cases, I started with direct field observations and then looked to historic records to help contextualize and understand my observations.

7.3.1 Design-time

The design-time origins of the Meraki system go back to the academic research project known as Roofnet. Working at the Massachusetts Institute of Technology's Computer Science & Artificial Intelligence Lab (CSAI), the Roofnet team was supported by a larger research initiative known

as Project Oxygen ("MIT Project Oxygen" n.d.; Chambers 2002; Aguayo et al. 2003). Project Oxygen was conceptualized and initially directed by Michael Dertouzos towards the end of his life. At the center of the Project Oxygen was a 'human-centered' notion of ease of use and network discoverability and visibility (Dertouzos 2009). Additionally, Dertouzos argued that flows of information and information processing should be understood as having 'value' to the extent that they lead to desirable outcomes. While the notion of network visibility and ease of use directly informed the early research agenda of the Roofnet team, the broader notion of information value foreshadowed a wide range of data collection and analysis capacities that became a central selling point of the Meraki system.

With the incorporating of Meraki the focus on (1) ease of use and (1a) network visibility became central features of their system and product design. Bringing Meraki to market also involved the decision (2) to embrace a cloud based architecture that streamlined the work of network administrators while simultaneously tying them into an ongoing subscription payment scheme. The Meraki cloud not only formalized an ongoing transactional economic tussle, it also represented a series of trust relationships over the management of network data. While ease of use was a top priority, the Meraki policy language gave network administrators the flexibility to tailor their use of the system. This involved a modularized design so administrators could opt in or out of specific services, and the ability to define detailed network topologies and hierarchies of administrative authority. This design approach was in many ways illustrative of the design principles laid out in the tussle argument. The Roofnet research team who went on to create Meraki were graduate students at the same research laboratory as David Clark in the early 2000s. But the design of Meraki probably had less to do with the Roofnet team closely reading the

tussle papers, than it had to do with Clark reading the room. For Clark, the articulation of design principles is part of a broader consensus process within the internet's 'technical' design community. One in which Clark and his co-authors reflect upon the design approaches they have observed, what they perceived as best practices, and their motivating values. As I argued in chapter 2, the tussle papers are not only a response to the rapid growth in internet use but its simultaneous commercialization. Within a few years of incorporating and bringing Meraki to market it was realized that the collection and analysis of network data could be useful for a wider range of concerns such as marketing and security. This not only led to the creation of an application programming interface that would enable developers to pull Meraki network data into their own programs, it also involved the creation of a Meraki 'market place' for vetted third party providers. Thus, with the widespread use of Meraki we not only see the accumulation of behavioral data on the part of Meraki and their immediate clients, we also see the formation of a complex ecosystem of third party vendors that exchange and process behavioral data coming from Meraki networks.

To reiterate the design-time aspects of the case study center on the research priorities of Project Oxygen and how it informed the design of Rootnet and eventual product design of Meraki. Within this trajectory the notion of information value, plays an implicit yet key role for motivating the (2) collection and visualization of behavioral data, in anticipation of numerous trust and economic related tussles. But the central motivating goal was (1) ease of use. As long as Meraki could make the work easier for network administrators, they could lock their clients into ongoing economic and trust related tussles regarding the administrative authority of their

networks. In the following configuration section, I discuss how the Meraki architecture aligned and enabled the legal and financial goals behind Whopper WiFi.

7.3.2 Configuration-time

Following the character of Meraki, the configuration-time aspects of the case study examine the terms of service and privacy policy documents for the 'Whopper WiFi' network to understand how the Meraki system was implemented across 17,000+ Burger King locations and the 20 some locations in Detroit ("Burger King: Restaurants 2009-2018 | Statistic" n.d.; "BURGER KING® Privacy Policy" 2018). In other words, if design-time aspects of the case study involved tracing the origin story of Meraki, configuration-time leads us to the organizational logic, decision making, and values of the Whopper WiFi network and the fast food industry. While most Burger King locations are privately owned franchises, the Whopper WiFi network and the data it collects is owned by Burger King and their parent company Restaurants Brand International (RBI). Having said that, the terms of service and privacy policy documents describe an ongoing exchange and sharing of behavioral data with third party vendors and partners, including franchises. In the case of Detroit, most of the Burger Kings were part of the Schostak family owned portfolio of roughly 60 Burger Kings across Michigan's Lower Peninsula region. Around the time that the Whopper WiFi network was built, the Schostak company sold their Burger King locations to a company called GPS Hospitality. GPS Hospitality is a large corporation in its own right, with thousands of fast food restaurants across the south, Midwest, and northeast of the U.S. In other words, there is a topology of proprietary relationships that the Whopper WiFi network formalizes in its configuration. From GPS Hospitality, to Burger King and RBI, to Meraki itself,

and other 3rd party data analysis vendors and social media partners, one finds a chain of custody with designated responsibilities surrounding the collection, analysis, and sharing of behavioral data. The configuration of Whopper WiFi involves a combination of both the legal policy documents and the formal Meraki system. While the policy documents articulate an organizational and economic logic that is representative of the corporate structures that constitute Burger King and their imagined use cases for the Whopper WiFi network.

Thus, to reiterate the configuration aspects of the case study center of the economic and trust related tussles associated with the Whopper WiFi data collection at 17,000+ locations. And the economic and trust related tussles that emerged as Burger King and Restaurants Brand International seek to leverage their network's data collection capacity to minimize liability and maximize profits. Central to this latter point is the sharing of data with 3rd party vendors and partner companies with little to no assurances for how this later may be used by others. In the following run-time section, I discuss the experience and priorities of a group of young men that depend on Whopper WiFi and other Free WiFi networks to get online.

7.3.3 Run-time

The run-time aspects of this case are primarily derived from my observations. Compared with the other cases, this is the only one that involves an encounter with the 'end user.' Of course we're all 'end users,' but the previous two cases focus on the work of facilitators working to help people use online applications, or network builders providing their local communities with free WiFi. In this case, I describe how a group of young men gathered outside their local Burger King to socialize and use the Whopper WiFi network to get online with their phones. With limited

residential internet, the young men relied on free WiFi and their phones to get online. In this regard, they were an example of what Pew research describes as 'phone-only' internet users ("Demographics of Mobile Device Ownership and Adoption in the United States | Pew Research Center" 2017). Despite their phone centric internet use, their phones had limited or no data plans. This meant WiFi was a desirable resource. Free WiFi was a resource worth seeking out and creating habits around. And while I initially met them outside Burger King, Angel and his friends used a wide range of 'Free WiFi' networks, including the Detroit public library's network, and even some community networks. In this analysis, I start with the tussles that are implicit to Whopper WiFi, and then move toward the 'end-user' and consider their relationship with Whopper WiFi as one of many networks.

In the case of Whopper WiFi, the reliance on Meraki meant Burger King was Cisco's paying customer. Thus, beyond the enforcement of this transactional exchange, the Meraki system was designed with their clients' interests in mind. As discussed in the previous configuration section, this translated into Meraki creating numerous systems that focus on collecting detailed behavioral data. In the case of Burger King, the Whopper WiFi network and the data it collects is legally framed as an extension of their corporate proprietary domain. Data collection is motivated by trust and economic tussles regarding risk management, and the possible use or exchange value of the data being collected. In this regard, data collection represents a new kind of monopoly rent on the use of space and one's network connectivity. Thus, the data collection capacities of Whopper WiFi are framed as a tacit quid pro quo. By using their network or simply having a WiFi enabled device, data about one's behavior is being collected, analyzed and used in whatever manner Burger King sees fit. One might describe this as a transactional economic

tussle, but often in a transaction both parties are aware that the transaction is taking place. Alternatively, one might describe this as extractive economic tussle.

Meraki informs many of these dynamics through the design of their system. While many choices are locked-in to protect the economic interests of Meraki, key choices are pushed to their clients. Notable decisions regarding the collection and use of behavioral data are made by the client organizations. The institutional priorities and cultural norms inform how firms and organizations approach these capacities, what they deem as acceptable behavior for both themselves, as well as acceptable behavior of the end-users. Connecting with the network includes users that rely on the network to get online and anyone that happened to be in physical proximity with a WiFi enabled device. Firms and organizations that are offering free WiFi have reasonable concerns regarding the security of their network. While this has the potential to be a tussle between end-users and network administrators, their interests and desire for security are often aligned. By contrast, the issue of economic incentives that motivate the collection, exchange, and analysis of behavioral data represents a potentially thorny issue regarding cultural expectations for relative anonymity and the surveillance of public space. The proliferation of a secondary (largely unregulated) marketplace surrounding the exchange and analysis of behavioral data comes with its own propensity for emergent tussles. For the time being this remains a largely implicit to the day-to-day experience or concerns of those I observed using free WiFi.

For Angel and his friends, differences in network policy or authority were less important than the network's availability, its physical location, and their ability to use specific mobile applications once connected to the WiFi. I observed their awareness of when and where Free WiFi was

available, and their physical movement between wireless networks. WiFi was one of several factors that made a location a viable social gathering spot or workspace. While their movement between networks was largely tied to economic concerns, their use of the internet and behavior was informed by distinct social and institutional settings they were embedded within. Their behavior and internet use was different at the public library than at Burger King, and so on. While their use of Free WiFi and habits for seeking it out was an example of an economic tussle, their movement between networks was emblematic of the tussle design principle of open interfaces. Clark primarily frames the notion of open interfaces as serving the interests of system designers and administrators, but in this case one finds that open interfaces enable the physical movement and connectivity of end users and their mobile devices. There are striking similarities and notable differences between the hypothetical use case videos and documents produced by the Project Oxygen research team, and the information behavior that I observed in Detroit. While Michael Dertouzos imagined that ubiquitous wireless networking would streamline the exchange of information and coordinating of white collar workers, in Detroit I encountered low income adults creating social habits around the availability of free WiFi because it enabled their use of mobile applications, including the retrieval of content and communication with friends.

In an areas where residential internet access and mobile data plans are in short support, the availability of "Free WiFi" at Burger King and other businesses represents central economic tussle. Angel and his friends regularly used the Whopper WiFi network to get online and use their mobile applications. The built social habits around the availability of free WiFi. Implicit to this economic tussle, was the practice of data collection. The exchange and use value of such behavioral data, motivated the creation of a marketplace of third party vendors and partner

companies that share and analyze the behavioral data on behalf of Burger King and many other commercial and retail clients.

7.4 Conclusion

In this chapter I analyze the three case studies central to the dissertation. My analysis is based on what I refer to as the multi-tussle approach. As previously discussed, the multi-tussle is an adaptation of David Clark's tussle concept (D.D. Clark et al. 2005). Illustrated in the case studies, tussles involve conflicting interests, with a combination of technical mechanisms and people, including the many cultural values, economic pressures, and legal structures that inform and govern behavior. In this case the multi-tussle approach extends the analytic framework developed by Clark and applies it to the organization and analysis of qualitative cases. Pulling from a combination of ethnographic observations and interviews, and historic records, the case studies discussed in this chapter represent examples of public service, community action, and commerce, and are thus illustrative of how heterogeneous forces embody and project values onto digital technologies.

The multi-tussle analysis is limited in its treatment of the three cases. The first notable limitation is in the uncertain delineation of time, be it design, configuration, or run-time, the multi-tussle approach overstates their distinct and sequential quality. They stand in for what in practice is a complex iterative and concurrent processes. Furthermore, the multi-tussle analysis acts as an analytic frame through which one can examine a particular case study. But as a framework, there

is no explicit treatment for how the three cases relate to one another. As I mentioned previously, the design principles that Clark describes as part of his tussle argument offer some limited language for summarizing a narrow facet of the relationship between the three cases, but this remains limited. Metaphors of ecology provide a language for thinking about the role that networked technologies play within urban landscapes, acknowledging the complexity of known and unknown interactions, and unintended consequences.

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Chapter 8: Conclusion

aerial view of Detroit, 2013 source: cnn.com

In this dissertation I have done two things. I presented case studies that illustrate how heterogeneous forces such as cultural values, institutional policies, and political interests can inform the design and use of internet technologies. Second, I proposed an analytic framework I refer to as multi-tussle, which I use in the analysis of the case studies.

The focus on qualitative case studies was informed by Ramesh Srinivasan's argument that digital networks should be understood as embedded within local assemblages and specific economic and political circumstances (Srinivasan and Fish 2017). Thus, using a combination of interviews, observations, and historic records, I put considerable energy into articulating the specificity of

Detroit as a site of study, and how cultural values and circumstances informed how internet-related technologies were designed, configured, and used within each case study. On a poetic and intuitive level, the three case studies represent a "networked ecology" (Varnelis 2008), illustrating how digital networks are embedded within Detroit's political economy.

My analysis builds upon David Clark's notion of internet "tussles" (Clark et al. 2005). In doing so, I proposed an analytic method that I refer to as multi-tussle. As I have discuss throughout this dissertation, tussles involve conflicting interests that are mediated by the internet. Tussles combine networked digital systems with people and the various ideals and values that motivate their use and design of internet-related technologies. In this regard, the multi-tussle approach is grounded in a non-deterministic, constructivist vision of technology, one in which values and choices inform the design and use of digital systems. While Clark developed the tussle argument from a systems design perspective and focused his analysis on one tussle at a time, the multi-tussle approach reorients and expands upon the tussle framework to facilitate the analysis of heterogeneous cases that have multiple, concurrent, and interlocking tussles and points of contention.

The design, configuration, and run-time sequence that the tussle framework presents is another way of describing how digital technologies and the internet are contingent on people's values and the choices they make. Citing actor-network theory (Latour 1990; Callon 1990), Clark argued that the internet's 'technical community' needed to take non-technical factors seriously. Following the explosive growth of internet use in the 1990s and 2000s, Clark was particularly concerned with protecting the 'open' quality of the internet. With no specific application in mind, the internet was initially designed as a 'general purpose' network. In other words, it was

the internet's relative 'openness' that enabled the success of the world wide web and subsequent innovations. According to Clark, if the internet is a 'global' network, openness had been the common value that made it such. While idealists believed that the internet's open qualities translated into an inherent moral substance that would promote a global civil society, by the early 2000s it was clear in Clark's writing that, while openness was a value worth protecting, it was simultaneously enabling emerging tensions and conflict. Thus, he describes the concept of economic and trust-related tussles.

Over time the popular and scholarly idealism that was projected onto the internet was largely displaced by stories of maleficence, government surveillance, and critiques that pointed to the internet, and its dominant commercial actors, as a colonizing and homogenizing force. Many of these issues and critiques can be described as examples of trust and economic-related tussles. While some trust issues can be addressed, or solved, through technical means, in many cases trust is, at its root, a social issue regarding who one trusts, or more accurately who *we* trust, given the networked quality of communications and behavioral data. Thus, contention among communities and other social actors, coupled with limited internet security, has foregrounded trust issues as a potent force shaping the future of networked services.

Besides trust-related issues, the tussle argument points to economic factors as the co-constitutive force influencing the experience and politics of the internet. Who pays, and how services are paid *for,* are critical issues, and ones that often dovetails with trust issues. While Clark focused on transactional exchanges, I extended the notion of economic tussles to include extractive and externalizing dynamics. Extractive dynamics account for the data collection practices that many

business models rely upon, and the public's limited understanding and equally limited legal protections surrounding how such data is used. While extractive dynamics can involve clear flows of data capture, and are often documented in legal agreements, externalizing economic tussles involve less obvious contingencies and flows of information, and thus less explicit legal documentation. Nevertheless, externalizing economic tussles produce tangible consequences.

For Clark, the tensions that exist between the ideal of openness and economic and trust-related tussles are clearly embedded within a political economy that involves governments, the private sector, and civil society (David D. Clark 2016). Clark points to the federally-funded research community as the vanguard of civil society, system designers and researchers whose values are aligned with the internet's little guy – end users. But as the case studies I've presented in the dissertation illustrate, the distinction between the public sector, the private sector, and civil society is often ambiguous when one traces a wider actor-network and longer-term historic trajectory. Nevertheless, as examples of community action, public service, and commerce, the distinctions made between the case studies presented in this dissertation reflect notions of laissez-faire capitalism and liberal-democracy and, thus, are aligned with Clark's assessment of how internet tussles are embedded with the political economy.

There are two key dimensions to the significance of the case studies that I presented in the dissertation. First they represent a multi-tussle analysis, which provides a nuanced representation of how trust and economic tussles inform the design and use of digital technologies. And second, with Detroit as a site of study, the cases provide a partial view of how networked systems reinforce and augment the urban political economy. In a city that has been characterized by the

have and have-not duality of the 'digital divide' concept, the multi-tussle approach provides a framework for a more nuanced analysis of how networked systems are involved in a struggle for control and power. Thus, this dissertation contributes to the field of information studies by providing both empirical cases and the multi-tussle framework. The multi-tussle approach provides scholars, interested in the social study of the internet, with an analytic framework for managing and thinking through complex heterogeneous cases.

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Chapter 9: Photo Essay

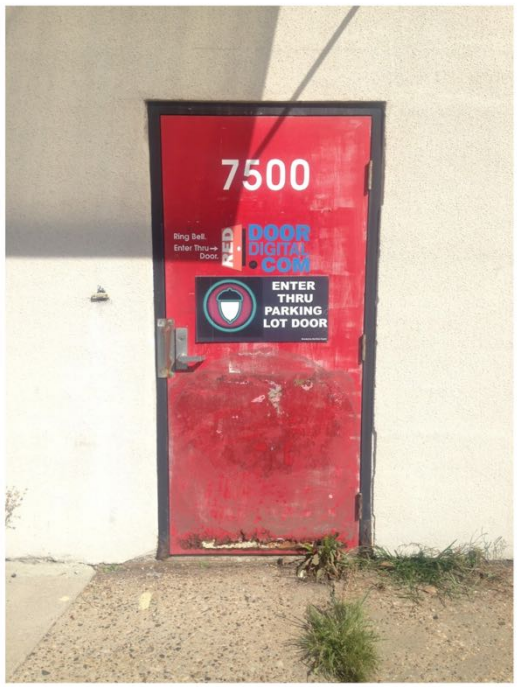
Boarded up windows means someone has plans for this building.

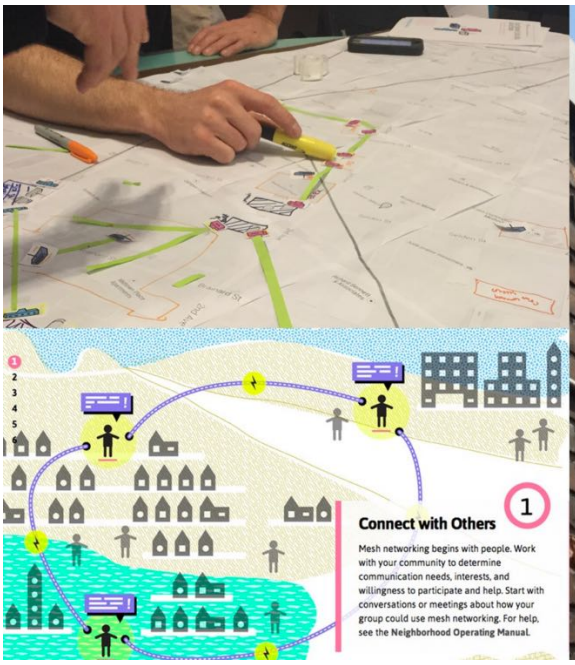
Missing streetlights.

Industrial ruins.

Demolition and depopulation has produced open areas in the city that almost feel rural.

Chris works to repair an abandoned home he hopes to claim ownership of.





Community networking organizing and the North End WiFi Network.

Oakland Ave Urban Farm.

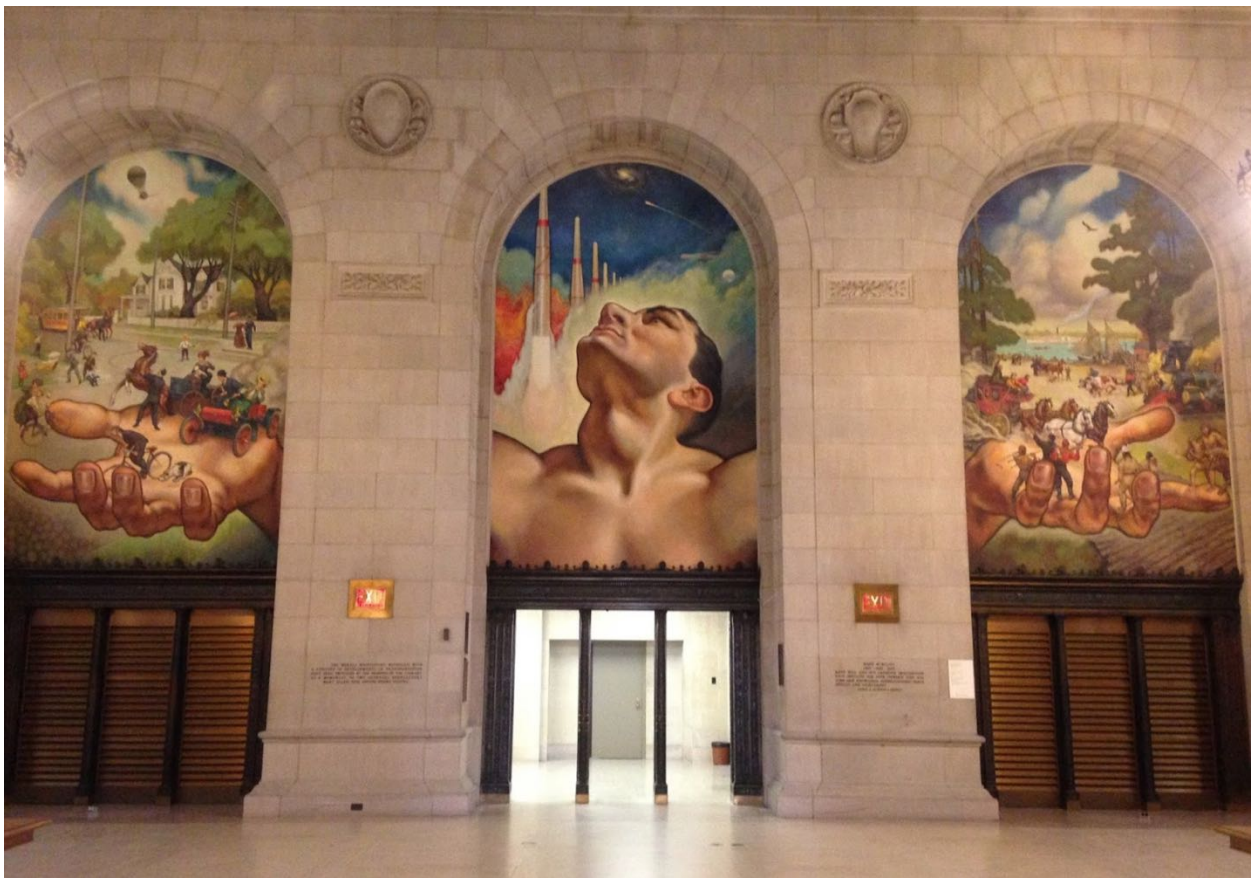
Sign from Avalon Village illustrates a common feeling for much of the city.

The Heidelberg project.

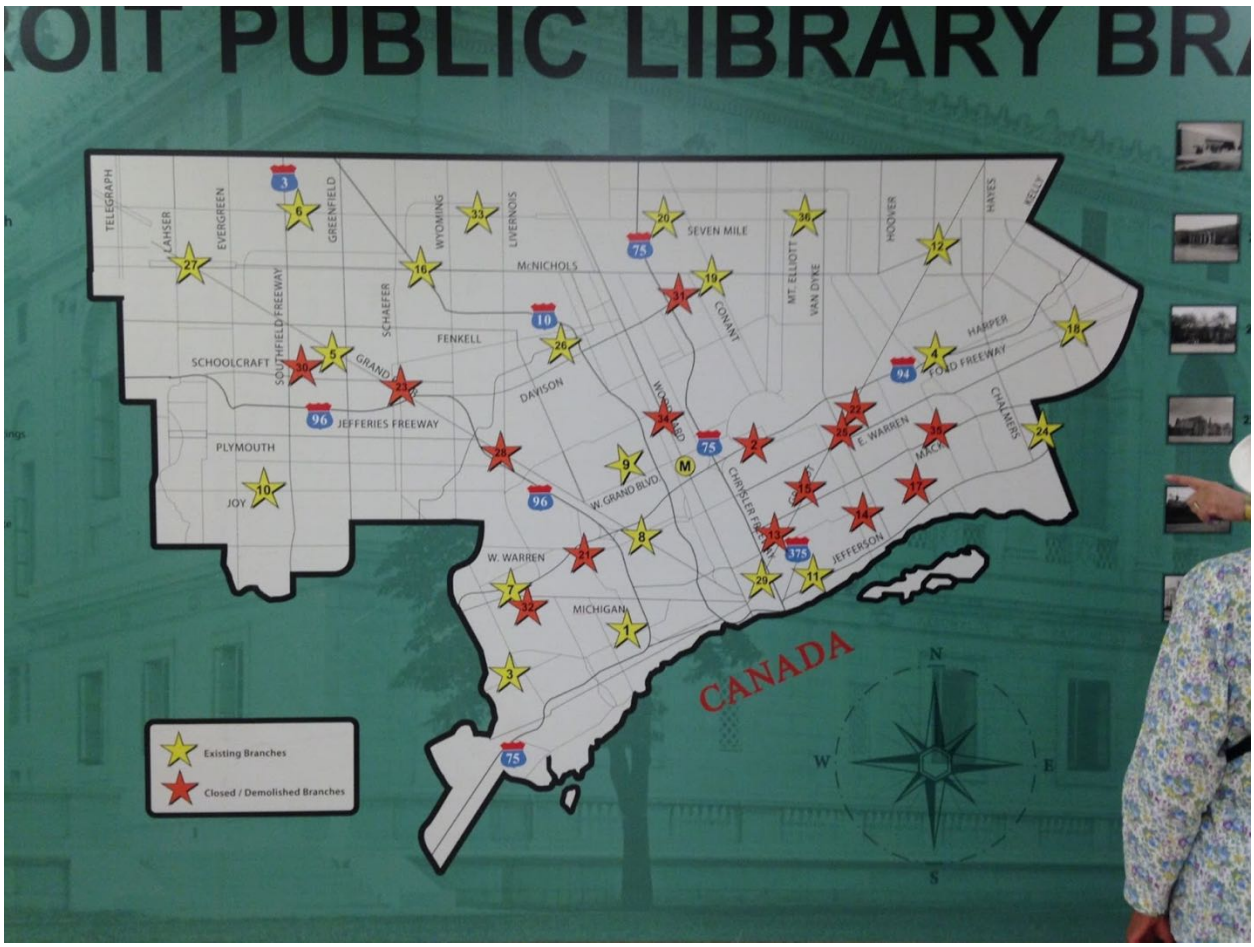

OF SIN IS DEATH
I will build

Urban blight and depopulation.

Bullet shell on the ground from a shooting that took place the night before.



A mural at the main branch of the Detroit public library.



A map of the library's many locations across the city.

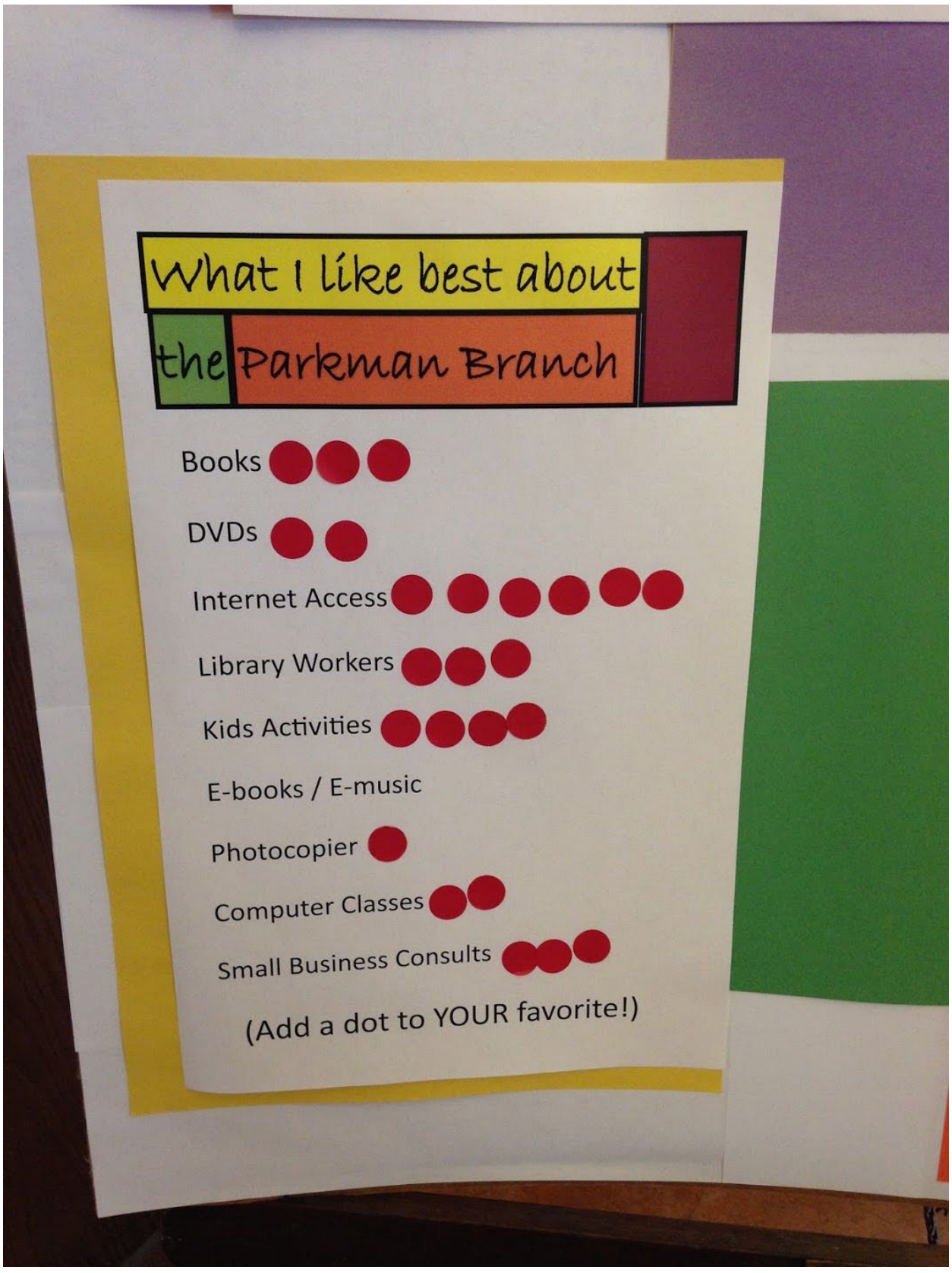
On a large globe at the main library, someone scratched Detroit off the map.

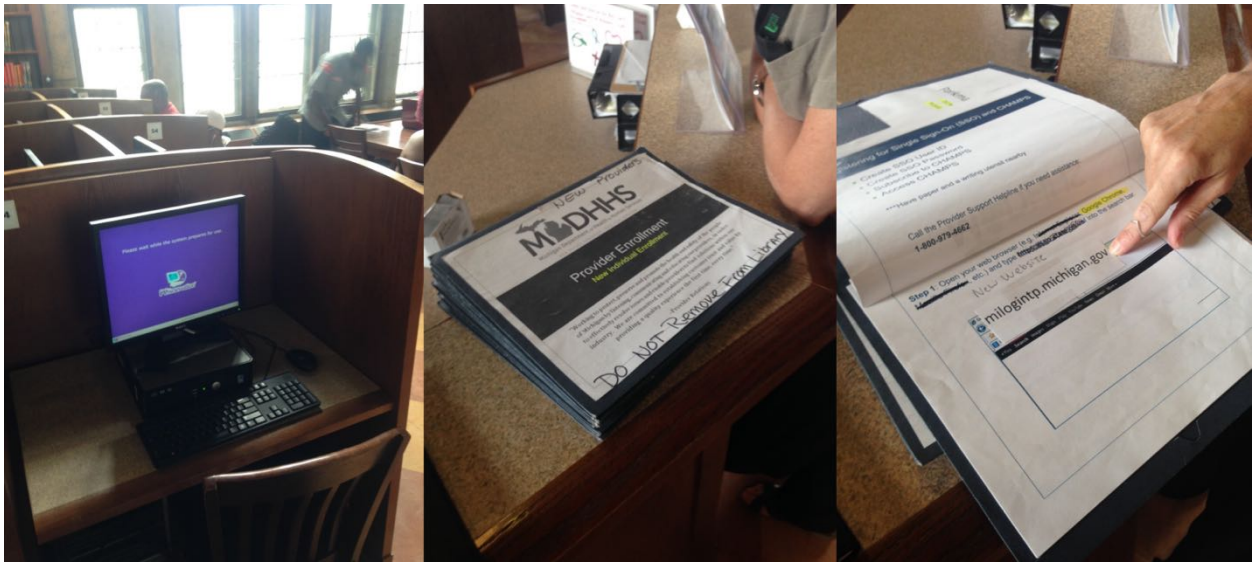
The Parkman branch of the Detroit Public Library.

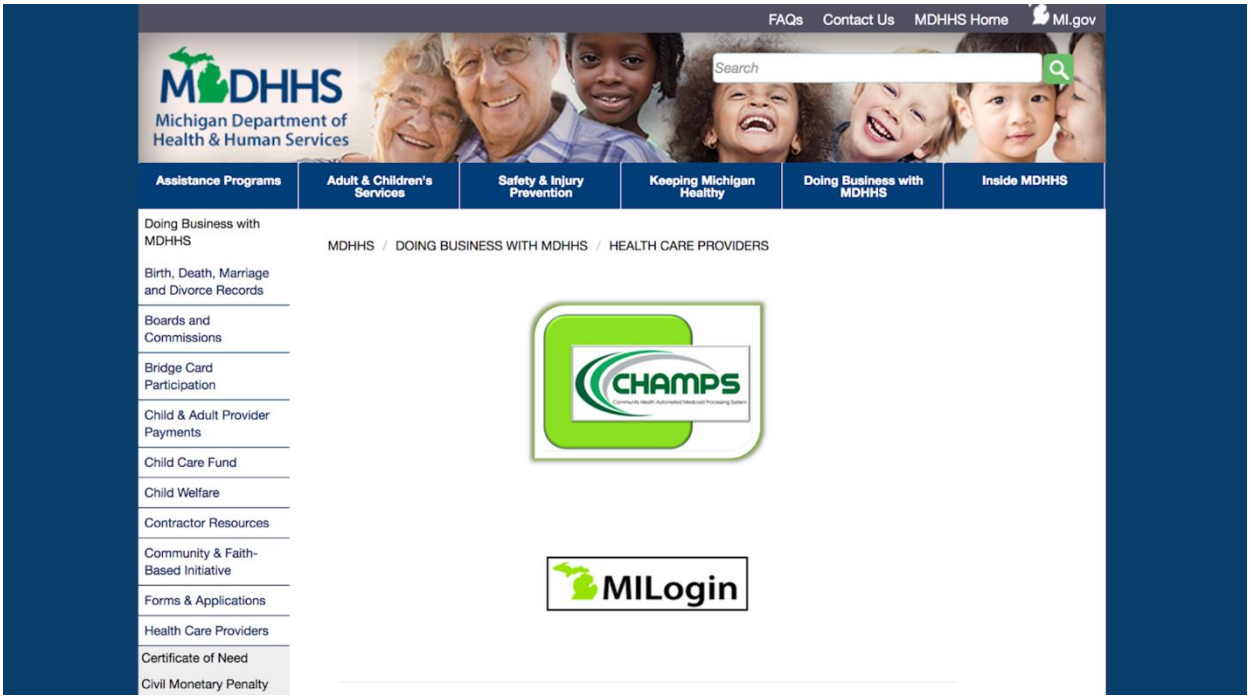

DETROIT
PUBLIC

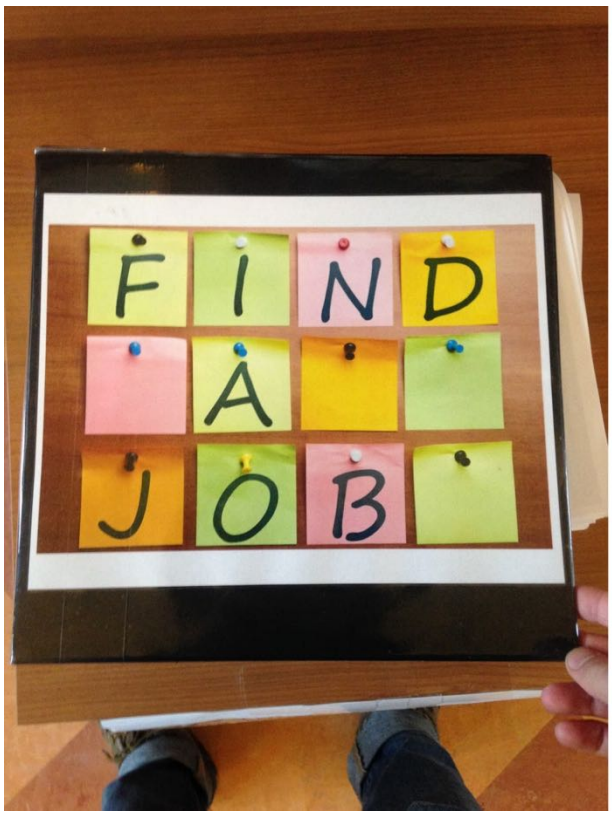

CyberConnection Center
CHILDREN'S
DVDs


TLC
Technology - Literacy - Career Center
Technology-Computer Skills Instruction
Literacy and Reading Improvement
Career and Employment Information

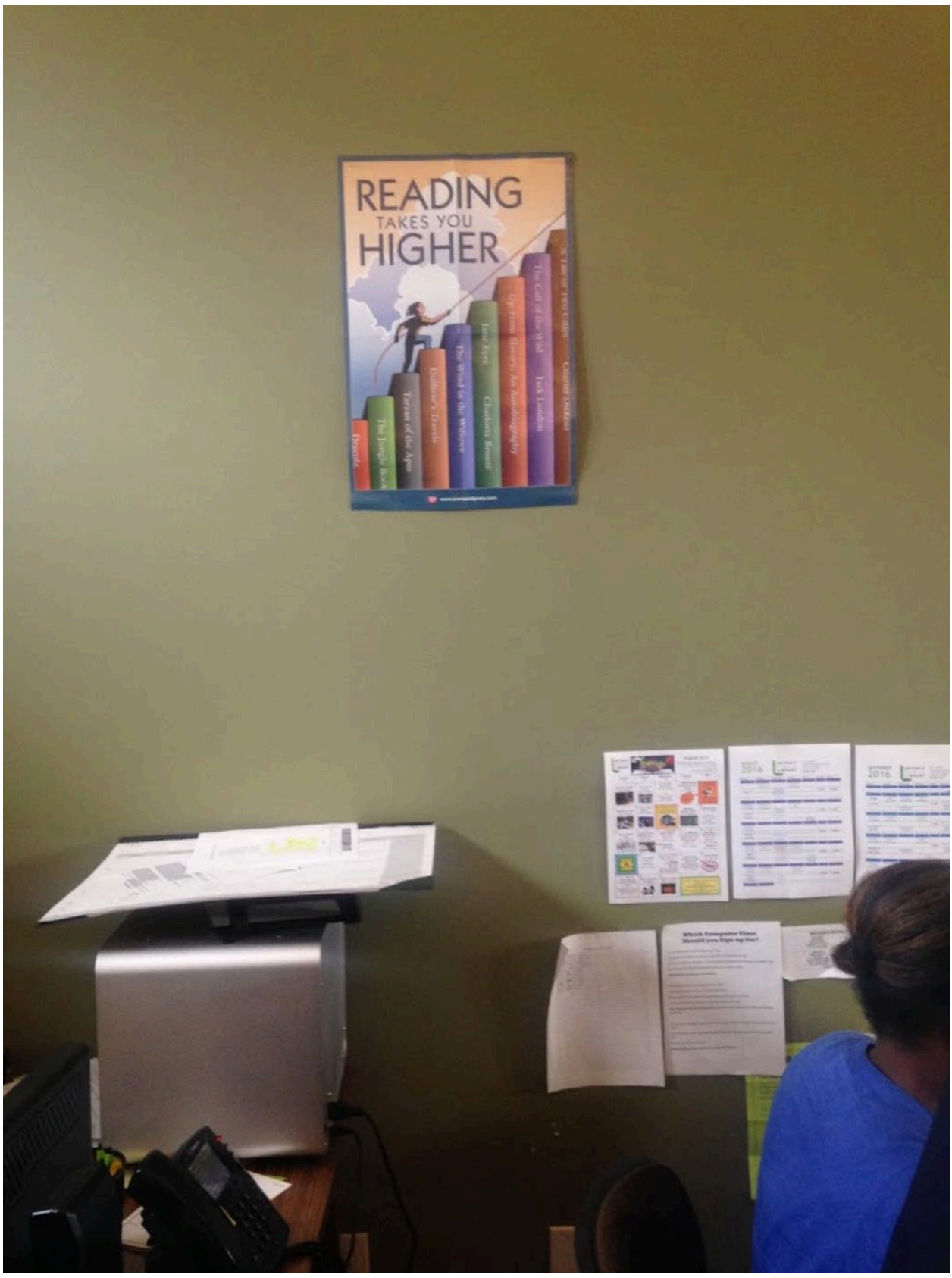

What I like best about
the Parkman Branch
Books
DVDs
Internet Access
Library Workers
Kids Activities
E-books / E-music
Photocopier
Computer Classes
Small Business Consults
(Add a dot to YOUR favorite!)

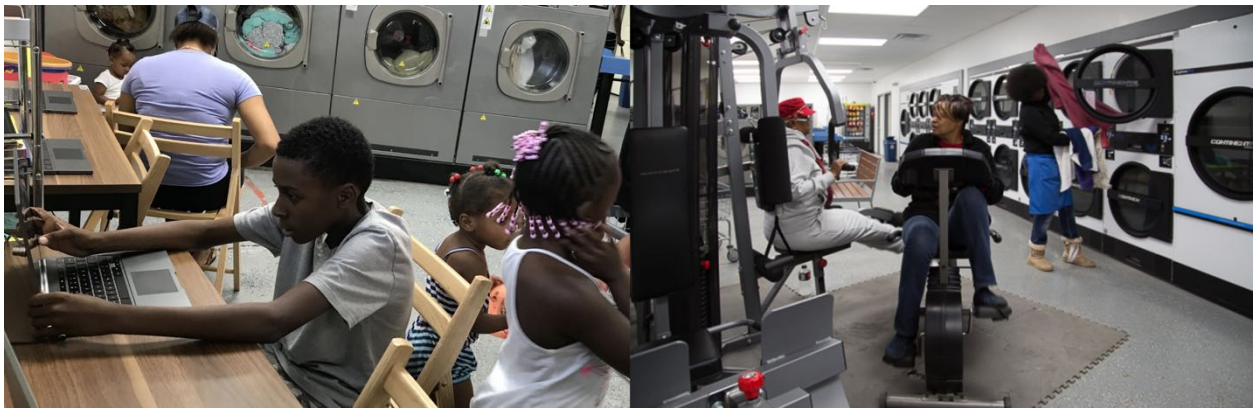

MDHHS
Provider Enrollment
DO NOT Remove From Library
Call the Provider Support Hotline if you need assistance
1-800-979-4662
milogintp.michigan.gov


FAQs
Contact Us
MDHHS Home
MI.gov
MDHHS
Michigan Department of Health & Human Services
Search
Assistance Programs
Adult & Children's Services
Safety & Injury Prevention
Keeping Michigan Healthy
Doing Business with MDHHS
Inside MDHHS
Doing Business with MDHHS
Birth, Death, Marriage and Divorce Records
Boards and Commissions
Bridge Card Participation
Child & Adult Provider Payments
Child Care Fund
Child Welfare
Contractor Resources
Community & Faith-Based Initiative
Forms & Applications
Health Care Providers
Certificate of Need
Civil Monetary Penalty
MDHHS / DOING BUSINESS WITH MDHHS / HEALTH CARE PROVIDERS
CHAMPS
MILogin


FIND
A
JOB


NOW HIRING!!!
TACO BELL
KFC
Pizza Hut
A&W
ALL AMERICAN FOOD
Hourly and Manager positions are available throughout Metro Detroit.
To apply go to their website:
https://www.perfecttacos.com/
Click on "Work for Us"
NOW HIRING!


READING
TAKES YOU
HIGHER



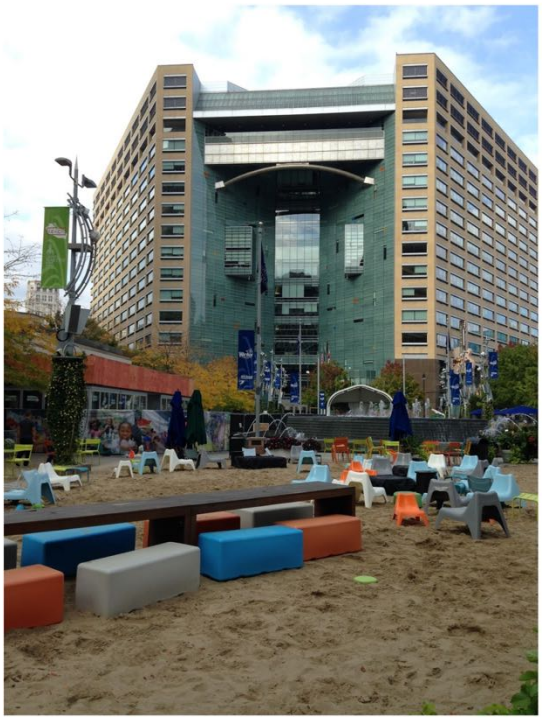
The local laundromat was dynamic community space and offered Free WiFi

"Whopper WiFi"

Neighboring buildings.

The “Qline” trolley car during its testing period. Named after Quicken Loans.

Rocket Fiber manhole cover in mid-town along the Qline.



Quicken Loans funded development of downtown Detroit.

top right: Protesters during the opening of the Qline.

The Rocket Fiber corporate office.

New streetlights installed by Quick Loans and their parent company Rocket Ventures.

The Michigan Central Station. The owners turned on the lights, a sign that more is to come.