NETWORK FRONTIER:

REFRAMING EXPLORATION AND EXPLOITATION IN INTERNET RHETORIC

by

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THESIS ABSTRACT

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The Internet is a product of the organizational structure of the Office of Science and Research Development, scientific corporate liberalism of Vannevar Bush's post-WWII policies, the process-oriented rhetoric in *Science: The Endless Frontier*, and Kennedy's commitment to the New Frontier. This thesis first examines the network infrastructure and then the Web in succession, following the common use of the metaphor, which moved from the rhetoric of science in the 1940s to a metaphor that financially and ideologically supported the Pentagon's Advanced Research Project Agency infrastructure in the 1960s and then finally created the value-laden features of the Internet, cyberspace, and its culture in the 1990s. This thesis connects the stages of development of the Internet to uses of the frontier in political rhetoric.

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CHAPTER I

INTRODUCTION

In 2015, the Internet hardly needs an introduction. It's a place of commerce, community, and opportunity. It's a place with its own etiquette, ethics, and geography. One history of the Internet might explore the technology and policy that brought the global network of networks into existence. The history I present in this thesis examines the Internet's changing meaning and values. No single metaphor more singularly illustrates the successive stages of the Internet than the one associated with the myth of the American frontier. The frontier metaphor often accompanies the conquest and creation of new spaces. This thesis begins with the premise that Cold War military goals commanded the development of Internet technology while the culture of the science community influenced the social construction of the network. The purpose of this thesis is to link the stages of development of the Internet to specific uses of the myth of the American frontier in rhetoric. First, I argue that the Internet is a product of the organizational structure of the wartime Office of Science and Research Development, the process-oriented rhetoric in Vannevar Bush's *Science: The Endless Frontier*, and Kennedy's commitment to the New Frontier, and that the rhetoric reflected the expansionist goals of the administrations during World War II and the Cold War. Second, I argue our conception of the Internet is influenced by how the scientific community built and used it, which is not expansionist, but collaborative, open, and democratic. Third, I demonstrate how the history of basic science and subsequently the Internet is also rooted in geography, specifically the Western states. Finally, I argue that rhetoric in the 1990s changed from expansionist to defensive of the collaborative, democratic nature instilled

into the network by researchers in face of normalization and settlement by corporations and government regulation. I also point to specific instances in the 1990s and 2000s where conceptions of the more established Internet resemble a post-Romantic fear of a savage place.

In each public address I examined, the presidents, activists, journalists, and even festival planners are mythmakers using the images from the old story of American westward expansion to develop a new story. They change the hero from pioneers to scientist, engineer, and researcher. They change the mythic universe from the Western states to research laboratories, and cyberspace. The myth is pliable. It can be a battle call for expansion into dangerous, unsettled territories or a plea to defend endangered spaces. In sum, the Frontier is exceptionally well suited as the metaphor for the Internet and basic science. The electronic frontier parallels the significant geographic spread and overarching cultural reach of the frontier in the myth of the American West. The Internet is also thought of as place of boundless opportunity. It's also important to recognize that these views are habits of a mindset that looks at the American frontier positively. I'll show in chapter 2 that the Frontier myth largely supplants the active extermination of Native people with "progress," and ignores other groups marginalized in history, including women, immigrants, and Southerner blacks. Western historian Richard Slotkin wrote a three-part book series chronicling the destructive edge of the frontier. But, of course, the frontier is a story, "a sequence of actions, a modern myth that combines belief, a structure of reality, superhuman forces, a pattern of behavior, and ideal characters" (Stoeltje, 1987, p. 250). One people's utopian frontier is another people's genocidal nightmare. The frontier is problematic, but important in the examination of the physical,

economic, and cultural landscapes of the Internet. Why would the scientific community and the American public relate to a violent origin myth? Slotkin points out that the myth regenerates among generations, and comprises three basic elements (Slotkin, 2000): the hero, the universe, and the narrative. Slotkin (2000) suggests that hero and universe (pioneer and frontier) are much more readily abstracted as images than the narrative as a whole, allowing audiences to identify with and enter the mythic world. The narrative then defines the relationships, actions, values, and the morality of the universe. According to Slotkin (2000), when a mythmaker changes the relationship of the hero to the universe, it illustrates a structural change in the relationship of the man to the environment and culture. As Burke (1969) points out, myths are necessary social functions to create a sense of interrelationship that leads to common social ends. Examining individual invocations of the frontier metaphor in rhetoric lends itself to a theoretical framework that preserves receivers' identification with the values and understanding of concepts communicated by the myth in its interpretation.

Metaphors allow the audience to see the problem and solution, and know immediately how to interact with both. A popular Internet trope claims that "all words ever spoken by human beings" could be stored in about 5 exabytes of data – or 5 billion gigabytes. Examining common usage, the metaphor illustrates both the mind-boggling size of an exabyte and also the rapid growth of data creation in the information age. Google CEO Eric Schmidt often receives credit for the popularization of the metaphor. In 2010, Schmidt addressed a convention audience claiming, "There were 5 exabytes of information created between the dawn of civilization through 2003, but that much information is now created every two days" (Schmidt, 2010). Bloggers covering the event

plastered the quote to their leads and headlines (Kirkpatrick 2010; Siegler 2010). *Time* magazine referenced Schmidt's quote again in its 2011 article, "How Big is the Internet?" (McMillan 2011). Internet entrepreneur Eli Pariser galvanized the quote even further in his book *Filter Bubble* prefacing it with: "We are overwhelmed by a torrent of information" (Pariser 2012). Media scholar Robert McChesney opens the first chapter of *Digital Disconnect* with the statistic. "If one digitally recorded all extant human cultural artifacts and information created from the dawn of time until 2003," he wrote, "one would need 5 billion gigabytes of storage space" (McChesney 2013). As recently as 2014, technology magazine *Computerworld* used the expression to describe the extent of government network surveillance (Storm 2014). The quote attributed to Schmidt even made its way into the latest edition of the *Encyclopedia of Information Science and Technology* in the entry for "Information Overload." The list goes on – and they're all wrong.

The metaphor comes from the now-famous 2003 University of California Berkeley study "How much information? 2003," which measured how much "uniquely created" information, was produced each year between 1999 and 2002. For three years, the team surveyed annual data creation and storage in four physical media: paper, film, optical, and magnetic, which included servers, disk drives, and camcorder tape. They concluded that humanity created 5 exabytes of new information in 2002. Rather than equating the massive information creation to the previous millennia of human speech, Lyman and Harian claimed in the report's executive summary that "five exabytes of information is equivalent in size to the information contained in half a million new libraries the size of the Library of Congress print collection." The phrase "all words ever

spoken by human beings" only appears once in the 113-page report, buried in a table showing the relative size of an exabyte. In October 2003, *Science* highlighted the study in a sidebar article titled "Data Overload," used the Library of Congress metaphor, and also noted that five exabytes is equivalent to 10^18 bytes – a figure that represents the *number* of words spoken by humans since the dawn of time. Harian, who currently works as Google's chief economist, confirmed via email the common usage wasn't their intended meaning.

Between 2003 and 2010, technology journalists and bloggers harkened back to the "How Much Information?" study. After 2010, they referenced Schmidt. The meaning shifted as soon as it left Berkeley, but Schmidt shifted the convenient metaphor to illustrate the difficulties his company faced as the Web search engine with the largest market share. Schmidt rebooted the trope and then it proliferated as a conflation of the quantity of information and the actual number of words supposedly spoken in all of human record. Whether the quote in its context is right or wrong is irrelevant, academia and the media reflected their conception of the Web in the phrase. Following sluglines like "Information Overload" and "Data Overload," the metaphor conveniently illustrated the scale of information, contextualizing the amount of data as overwhelming. Metaphors are changed by and also influence the cultural context. For the people who use the metaphor, the accuracy isn't important as the idea – the signification behind the signifier. Lyman and Harian quantified the issue while Schmidt both pointed to an issue and also assured the convention attendees that Google had it under control. In his remarks, he posed a problem and also maintained that Google was working on a solution.

One year after the runaway metaphor from "How Much Information? 2003," global annual Internet traffic surpassed the exabyte range for the first time. In 2006, International Data Corporation report measured 161 exabytes of data. Cisco thinks global IP traffic will surpass the zettabyte barrier by the end of 2016. In just two decades, the Internet has evolved several lifetimes. In 2010, mobile phone traffic alone contributed 40 exabytes to global IP traffic. By 2011, the global Internet infrastructure ran out of its initial 5 billion IP addresses, creating new demand for the next iteration of the Internet packet-switching protocol. There are many ways to measure the exponential growth of the Internet and also describe it in metaphor. The idea of information overload goes by many names: information anxiety, information pollution, information glut, and data smog. While the media express information overload as an issue facing the Internet-connected public-at-large, it's not a new concern for corporations or the government. As early as the 1930s, these organizations were building and using computers to analyze their operations and sort their data. The solution to information overload itself was originally using computers. Today, computers contribute to the problem of information overload. By most accounts, the history of computing serves as the starting point for the history of the Internet – both of which were initially funded and used by the military.

The 1960s offer a reasonable first entry into the modern era of computers, but many world events changed the context of science and communication between the end of World War II and ARPA's first experimental network in 1971. Among the most important events to this timeline, the government institutionalized the wartime structure for funding science in the United States, galvanizing the military-industrial-academic collaboration started with the wartime Office of Science and Research Development and

the Manhattan Project. The Eisenhower administration responded to the 1957 Sputnik 1 launch by hastily funding an agency to handle military research for the Space Race. Kennedy launched the Moonshot, publicly charging engineers and scientists with facing down the Soviet Union. The Cuban Missile Crisis showed the military's serious flaws in their abilities to command and control their nuclear assets. These events contributed to the development of the Internet with successive metaphorical uses of the American frontier.

It's important as we look at the rhetoric of science to also look at the individuals, where the history was lived. This thesis will toggle back and forth from examining the national rhetoric that contains the frontier metaphor to the history of the individuals who actually created the technology. For national rhetoric, I'll use a rhetorical analysis in the context of the Turnerian Frontier Thesis, which serves as the basis for the foundation myth. Looking at the hero, narrative, and universe, it'll be possible to examine the values and agenda that persuaded the policymakers and the public to support a national infrastructure for science funding. For the individual moments of history, I'll use historical discourse analysis, interpreting the history of the Internet as a continuation of the successive frontiers from the discipline of Western history. As argued by Western historians, the metaphorical frontier has many layers – physical, ideological, political, rhetorical, and mythical. I'm using two different methods because I am examining the influence of a process on a social structure. Dissecting the foundational myth while focusing on a single layer provides a flat analysis without the necessary points for comparison.

In the first chapter, I'll recount the origins of the myth of the American frontier, discuss the intellectual history in Western history, and establish the values associated with the wilderness and also frontier. In 1893, historian Frederick Jackson Turner presented his Frontier Thesis. The pioneers became the symbol for desirable national characteristics: self-reliance, rugged individualism, entrepreneurialism, and tenacity. In the story, they needed these traits because they lived on the edge of a savage land, making way for civilization.

In the second chapter, I'll trace how the intellectual history of Western history parallels and informs the usage of the metaphor that created the military-industrial complex. The idea of government-funded research during World War II wasn't necessarily novel, but the scale certainly was. Universities melded with military and industry almost seamlessly during the total war. After the war, the OSDR was seen as an unclean thing that needed to be dismantled. As the director of the OSDR, Vannevar Bush, a computer scientist and first perfunctory science advisor to the president, drafted a document to guide the reassembling of the science community in the post-war era, it's title: *Science: The Endless Frontier*. Bush made scientists the pioneer hero in the endless frontier of scientific exploration. Unfortunately, his recommendation failed as he envisioned, but the relationships between the military, universities, and industry persisted. Post-WWII policies kept the money flowing into universities through the military – creating the military-industrial-academic complex.

In the third chapter, I'll show how the pieces of Bush's science policy that *were* enacted, created the infrastructure for the Kennedy administration's New Frontier. Kennedy's new metaphor created new heroes and instilled them with new values,

rerouting government grants into the new Cold War efforts, including an experimental network called ARPANET, which is the predecessor of the Internet. I argue our conceptions of the Internet is influenced by how the scientific community built and used it, which is significant because the distributed network, one of the democratizing features, was initially built for the incredibly vertical, centralized military. Early justifications for Internet funding included making the country's communication infrastructure survivable in the event of a nuclear attack, and eventually simply a way for researchers to share computers more effectively. By this, I mean there were only a few computers in the country at the time and ARPA didn't want to give every university their own computer, so it was a cost saver. The researchers who built he Internet built certain military values into the network – survivability, scalability, which are valuable. They also built the network with values that privileged sharing resources, ideas, and functionality rather than direct action through a vertical chain of command. The purpose of ARPANET was to develop a body of knowledge accessible to everyone. Though this seems obvious, I argue that had the Internet been created solely for corporations and government bureaucrats, it would have ended up as analogs to those rigid, vertical structures.

In the fourth chapter, I'll explain how the ARPA engineers created a new frontier in the Internet and continue to explain the social construction of the Internet in the 1990s. One of the often unspoken tenants of the frontier is that the frontier eventually becomes civilization. In the 1990s, John Perry Barlow built an organization to defend the Internet against media consolidation, overreaching government regulation, surveillance, and censorship. With the dotcom rush in the 1990s and the establishment of Internet behemoths such as AOL, Amazon, EBay, and Facebook, we see the rhetorical settlement

of the Internet space. In 1906, Teddy Roosevelt used the frontier to defend 8 million acres of Western land against industrial development. With the seemingly unlimited space of the Western states, politicians could call for expansion. Once the frontier closed, however, calls for expansion turned into pleas for defense of a finite, cherished land. We see the same pivot in 1990s with organizations like the EFF turning their legal resources toward the government and industry. Ultimately, I argue they defend the values initially instilled into the network by ARPA researchers.

The nature of the Internet derives from the values and cultural meanings instilled by collaborative engineers and scientists to solve a geographic problem with a technical solution. With the popularization of the Internet, engineers dematerialize the technology into metaphor so that first-time users might understand their inventions and innovations immediately. Computers themselves are metaphors and representations for the way the scientific community conceives the human brain and memory. Within the conception of the Internet, policymakers and scientists fold metaphor into rhetoric to instill new values and uses in the network. As we study the Internet, scholars, technology gurus, and the collective "Internet" create new tropes to illustrate and reinforce the nature of the network – a network the scientific community created in its collaborative likeness. By tracing the rhetorical history of the Internet, it's possible to recount the agendas, resources, and visions of the people who conceived the global network of networks.

CHAPTER II

THE FRONTIER THESIS

In 1893, Frederick Jackson Turner presented his essay "The Significance of the Frontier in American History," colloquially known as the *Frontier Thesis*, to the meeting of the American Historical Association in Chicago. Turner argued that distinctly American values existed as a result of the nation's westward expansion and contact with a wild terrain. As the United States attempted to define its national identity in the nineteenth century, ideas coalesced around the frontier as "something uniquely American" (R. Nash 2001, 35). The Old World might have had centuries of civilization, but the New World had massive tracts of land unmatched in Europe. However, having lots of land was not a unique quality. Europe had land, too. To be uniquely American, the land needed to exemplify a purely American element – it's wildness (R. Nash 2001). The scale of wilderness present in the New World, and the people who conquered it had no Old World counterpart, thus the beginnings of the national identity. For 250 years, a physical boundary delineated the artificial bubble of civilization and the American wilderness on the Western edge of the United States. Key to this definition is the premise that America's wilderness physically moved and culturally changed in those centuries, impacting definitions for both civilization and wilderness.

The Internet, science, and the Frontier Thesis are inexorably linked. The broad stroke of the Frontier Thesis was the embryo of an academic discipline, just as the broad stroke of Bush's *Science: The Endless Frontier*, and Kennedy's New Frontier created and implemented the contemporary framework for publicly funded science. By the 1990s, the frontier served as a suitable metaphor for the geographic expansiveness of the Internet

and its value as an economic and social platform. Given the powerful response to the Frontier Thesis in contemporary political rhetorical supporting science and widely accepted parallels between the Internet and the 19th century frontier condition, it's useful to examine the origins of the myth of the American frontier, discuss the intellectual history in Western history, and establish the values associated with the wilderness and also the frontier.

Since the frontier metaphor often accompanies the conquest and creation of new spaces, then it's necessary first to start, like Turner, from the year the frontier closed in 1890. The 1890 Census is important to modern statecraft, computing, and the myth of the American frontier in a few ways. First, the census was the most radical data collection effort by the U.S. government about its citizens in its history until that point. Its success was only made possibly by a computing machine. Second, the mechanical enumeration was the culmination of a long history of increasingly improved government technics for measuring the U.S. population and its holdings. Finally, the 1890 census was the first time the U.S. government successfully enumerated the Native American population, measured the nation's industrial prowess, and collected data about its national resources, marking the victory of a two-century war with nature and the indigenous people.

In 1890, the U.S. Census Bureau for the first time enumerated the country's population with a machine. Designed by former census employee and founder of the Tabulating Machine Company, Herman Hollerith, the Electronic Tabulation System employed a punch-card technology that could process 0.53 cards per second. Though the Tabulator machine couldn't add, subtract, divide, or multiply, it *could* count. As census marshals returned their census sheets, clerks used red ink to add alphabetical or numerical

codes in certain schedule columns for technical operators to punch into cards. Tabulator operators then fed the punch cards into the machines for tabulation. The 1880 census took seven years to enumerate 50,189,209 people and compile industrial and economic statistics. The 1890 census took only two and a half years. The Census Office announced a "rough count" of the population after only six weeks of processing and then released the official numbers after the tabulation office in Washington, D.C., received the last returns, which were "delayed in the mail by being improperly addressed" (Wright and Hunt 1900). Hollerith's tabulation machine significantly improved census processes, allowing policymakers to collect and compile increasingly granular data about the population and economy. U.S. Census Bureau Superintendent Robert P. Porter writes proudly in the 1896 population report abstract, "Statistics regarding the conjugal condition of the people of the United States are presented for the first time as a part of the United States census" (7). He notes that previous censuses, namely in 1870 and 1880, collected the data, but "means were not at hand for its compilation" (7). Though a required function of the U.S. Constitution to establish districts for the members of the House of Representatives and distribute electoral votes, the decennial census only started in the late nineteenth century, providing the opportunity for the Secretary of State to investigate social issues and economic trends.

If the history of the Internet parallels the history of the computing, then there are two important two side notes about Hollerith and his Tabulator. First, Hollerith founded the Tabulating Machine Company in 1896, and then merged with International Time Recording Company, Bundy Manufacturing Company, and the Computing Scale Company in 1901 to form a new corporation called the Computing-Tabulating-Recording

(CTR) Company (*The New York Times* 1911). In 1924, the CTR board of directors changed the company name to International Business Machines, or IBM. Second, I mentioned in chapter one that early as the 1930s, government organizations were building and using computers to analyze their operations and sort their data. The punch card-operated Tabulator marks an early manifestation of Habermas' "instrumental rationality." Hollerith's punch card design dominated computer design for nearly a century. Thomas Streeter points out in *The Net Effect* that the large machines "predictably carried out routine tasks that were tightly specified beforehand from on high; this fit the corporate model to a T" (Streeter 2011, 28). In the 1960s business computing was the fastest areas of growth with IBM the leading vendor industry (Streeter 2011, 28). IBM will show up again in the second and third chapters as a major government contractor for computing machines. I argue that had the Internet been created solely for corporations and government bureaucrats, it would have ended up as an analog to those rigid, vertical structures, similar to the Hollerith machine and its successors.

Hollerith's counting machine provided the means for the first detailed map of the U.S. population and its holdings, marking a major milestone for the U.S. government's ability to collect information about its citizens. The first census in 1790 collected the name of the head of the family, and the number of people in the family described as: "free white males of 16 and upward; free white males under 16 years; free white females; all other free person; slaves" (Gauthier 2002). Marshals set out on the first Monday of August 1790 under order of Congress to enumerate the population, using as many assistants as they deemed necessary to complete the count in nine calendar months. Each marshal had another three months to count their results and transmit them directly to the

President. Severe financial penalties awaited any marshal or assistant who falsified records or failed to file their returns. The first enumeration was printed in a small octavo pamphlet of 56 pages, stating the colonial population of the United States as 3,929,214 people – dispelling the exaggerated colloquial estimates preceding the first systematic enumeration (Wright and Hunt 1900).

As the U.S. population grew, the enumeration became more complicated, requiring the Census Bureau to improve technics. Until 1830, state census offices and individual enumerators supplied their own schedules for the U.S. Census; using whatever paper they had available. Without uniform schedules, U.S. Census superintendents relied on scattered, incomplete data to compile statistics about population, and left them unable to track social and economic trends. For the 1830 census, the U.S. government printed uniform schedules with detailed instructions for enumerators, significantly improving their ability to collect accurate, standardized data. Centralized control over the collection of standardized data allowed superintendents to direct research beyond basic population statistics toward issues deemed nationally important by the Secretary of State. The 1840 Census Act authorized the collection of statistics pertaining to "the pursuits, industry, education, and resources of the country" (Gauthier 2002, 125). Beginning in 1850, census marshals started collecting social statistics such as taxes, schools, crime, mortgages, mortality, and mental illness. As manufacturing centers grew in the United States, the Bureau attempted to collect data about economic output in the 1860 and 1870 censuses. But these attempts failed, so the 1880 Census Act replaced marshals with specially appointed agents to collect technical data on manufacturing processes. The 1880 Census report featured 19 additional special volumes for industrial statistics, including

agriculture, mining, transportation, telecommunications, petroleum production, and water power. U.S. Census Bureau data collection, classifications, and special reporting are particularly telling about a decade's social, economic, and political issue foci, so it's interesting when the same census report that "officially" closes the American frontier also issues a special report enumerating Native Americans. After a failed attempt to count the extant Native population in 1880, the U.S. Census Bureau issued the first complete special report in 1890.

Superintendent Porter opened the first volume of the 1890 census results with a paragraph of significance for the history of the frontier and the United States:

> Up to and including 1880, the country had a frontier of settlement, but at present the unsettled area has been so broken into by isolated bodies of settlement that there can hardly be said to be a frontier line. In the discussion of this extent, its westward movement, etc., it can not, therefore, any longer have a place in the census reports (35).

With closing of the American Frontier, Porter concluded that the census would no longer collect data about Westward expansion. The 1890 census signaled that the war against the Western lands and the indigenous people who inhabited them had come to an end. It was time for America to fully evaluate its spoils. The 1890 census was the first enumeration of Native Americans living within the jurisdiction of the United States, including the reservations. Each schedule from 1830 to 1860 was designed to enumerate all free people "except Indians not taxed," meaning Native Americans living on the reservations or subsistence living (Gauthier 2002). Instructions for the 1870 and 1880 census asked the marshals to enumerate the Native population in their territories for a special report to the census office because it was "highly desirable, for statistical purpose,

that the number of persons not living on reservations be known." (Gauthier 2002) Though ordered to seek out Native people, enumerators for the 1870 and 1880 censuses failed to comprehensively document the population. The closing of the frontier gave the government impetus to tally the extant Native populations living both on and off reservations. The Hollerith's Tabulator provided the necessary technology to count the country's population faster and more accurately than ever before.

The 1890 census also inspired a young historian to write an essay that established America's national identity and a new Western history. Turner's Frontier Thesis refers to the aforementioned quote by Superintendent Porter in its first line and then develops his argument for American exceptionalism, frontier values, based on the nation's relationship to wilderness.

> "This brief official statement marks the closing of a great historic movement. Up to our own day American history has been in a large degree the history of the colonization of the Great West. The existence of free land, its continuous recession, and the advance of American Settlement westward, explain American development" (Turner 1).

In this opening statement, Turner sets up an argument sets up an argument that's been debated by historians, used by politicians in rhetoric, and reconstructed in film and media. His argument was that distinctly American values existed as a result of the nation's westward expansion and contact with a wild terrain. Turner defines the frontier as "the outer edge of a wave – the meeting point between savagery and civilization" (Turner 2013). His remarks about the "savagery" of wilderness require deconstruction because remnants of the values that Turner associates with the untamed Western states carry over into the contemporary metaphorical wildernesses (and frontiers) of science and the Internet. To understand the frontier as a symbol, it's equally important to understand the

definition of wilderness, the changing historical perspectives of the frontier, and their limitations.

In the seminal environmental history *Wilderness and the American Mind*, Nash traces cultural constructions of the wilderness from ancient to contemporary times. In Nash's pre-Romantic conceptions of the wilderness, he pulled apart the Bible and medieval texts. In classical mythology, he found demons, wild beasts, and semi-human men inhabiting wild places. In the Bible, he recognized the wilderness as the antipode to paradise when Adam and Eve were cast into the wilderness, but also as a place of religious purification as Christ was tempted in the wilderness. In the Middle Ages, he points to religious groups entering the wilderness as a place of refuge, but on the whole, he concluded, "Western thought generated a powerful bias against wilderness and the settlement of the New World offered abundant opportunity for the expression of this sentiment" (R. Nash 2001, 22).

As late as the eighteenth century, American usage of the word "wilderness" connoted a useless, dangerous, unorganized area. "In it's raw state, it had little to offer civilized men and women" (Cronon 1995, 71). In the frontier myth, pioneers developed the land, overcoming nature and the indigenous people with technology and making the land useful, but they still sat at the edge of fearsome nature (R. Nash 2001). The wilderness was still an enemy that had to be conquered, vanquished, and subdued. The pioneer mission was to bring civilization to the wilderness, but first the pioneer needed to break the wilderness to make it useful. Only once they built their homesteads and farms was nature useful, beautiful, and friendly, as suggested by the Jeffersonian notion of the pastoral ideal. The distance from civilization and wilderness are important in the frontier

thesis. Too much "savage wilderness" and a "man may become savage" (R. Nash 2001, 45). Following this idea, Cronon points to two naturalists who stepped over the line.

Early Romantic poet William Wordsworth favored an awe-filled bewilderment when interacting with the wilderness as when he wrote about climbing the Alps in the poem *The Prelude*. "The symbols he detected in this wilderness landscape were more supernatural than natural, and they inspired him more awe and dismay than joy or pleasure" (Cronon 1995, 74). When transcendentalist author Henry David Thoreau climbed Maine's famed Mount Katahdin in 1846, he felt "a stern loneliness," even despite the fact that he made trip while sojourning on the shores of Walden Pond. In his book *The Maine Woods* recording his trip, Thoreau recounted a fearsome experience summiting Katahdin during a storm. He described the mountain as "vast, Titanic, and such as man never inhabits." As he fights for purchase on the summit, he anthropomorphizes Nature: "She seems to say sternly, why came ye here before your time? … I cannot pity nor fondle thee here, but forever relentlessly drive thee hence to [the valleys] where I am kind. Why seek me where I have not called thee, and then complain because you find but a stepmother" (Thoreau 1988, 34). Wild country might have offered Thoreau necessary freedom and solitude, but he got too close. Ultimately, however, Nash points out that Thoreau's writing was only ever superficially about the natural world. "Following Emerson's dictum 'the whole of nature is a metaphor of the human mind,' he turned to it repeatedly as a figurative tool" (R. Nash 2001, 89). In the nineteenth century, Romanticism recast the wilderness as something sublime, rather than fearsome. Nash asserts that appreciation for wilderness started in the city, in the parlor, in literature among the affluent and elite. If nineteenth century Americans built a

civilization from the raw materials of a physical wilderness, then they equally built wilderness from the cultural materials of civilization. Romantic writers concluded it was best for a person to live with a foot in the civilized, and also in the wild, idealizing a middle space (R. Nash 2001). While wilderness was fearsome, too much civilization, and he will be come anxious and dull.

Urban populations exploded in the late nineteenth century. “In 1880 there was but one city, New York … In 1890 there are three, New York, Chicago, and Philadelphia,” wrote Superintendent Porter writes in the 1890 census report (1896). As early as the 1830s, rapid urbanization prompted a political doctrine that wielded free land as a weapon against the industrialization of society – the safety value. The doctrine maintained that as long as there was free land on the frontier, then the people filling the cities always had a place to turn for relief from unemployment and poverty. As Horace Greeley said in 1837 while encouraging emigrants to leave the cities after the Panic of 1837: “Go West, young man, go forth into the country.” Ultimately, the West would serve to keep down social conflict in the East. In Europe, “the poverty of urban laborers had begotten a depravity, a dependence and corruption which would make them undesirable citizens in a republic” (Smith 1971, 203). Thomas Jefferson thought back to the conditions in Europe when he wrote free land would encourage industrial workers to “quit their trades and go to laboring the earth” if industrialists attempted “to reduce them to the minimum of subsistence” (Smith 1971, 203). Historians and social scholars debate whether the Homestead Act either helped Western farmer or Eastern laborers, but it’s certain that Turner was particularly concerned that with the frontier closed, the “safety valve” also closed.

The wilderness-civilization dichotomy serves as a necessary backdrop for a discussion about the Frontier Myth, and its dialectics between Westward expansion and nationalism, technology and nature, and rugged individualism and community. While Nash (2001) later defined the frontier merely as the boundary between civilization and the wilderness solely on location, Turner's thesis is important because it emphasized the values frontier inhabitants adopt because of their location. Pioneers are masters of material things, restless, independent, collaborative within their communities, direct in action, curious, entrepreneurial, and ruggedly determined (Turner 2013). Most importantly, they acquired those traits as a result of their interaction with wilderness. These values are easily traced forward into political speeches by Teddy Roosevelt in defense of national public lands, Vannevar Bush's Endless Frontier for publicly funded science, and John F. Kennedy's New Frontier.

Turner found such momentum for this idea because it veered sharply from the dominant historical perspective at the time, which claimed American national identity was still attached to the Old World. The East coast of the United States was settled as the frontier for Europe. While Turner's Frontier Thesis is considered the genesis of Western history, historians disagree where the West begins. The boundary lines and values of the West are major issue in one of the largest paradigm shift in Western history – the shift from viewing "frontier as a process" to "frontier as a place."

The contemporary fields of Western and frontier history are separated into several groups: Turnerians, regionalists, and most recently "so-called" New Western Historians. As paradigmatic boundaries shift, the names change to distinguish the new borders. Historians who subscribe to the Turnerian perspective generally view the frontier process

as initiated when Quaker settlers landed on the eastern coast of the United States. Ostensibly, the settlers landed in England's transatlantic frontier. When Western history developed into a separate field of study under the tutelage of Turner, it involved isolating not only a portion of America from the rest, but also all of America from Europe. New western history takes as its starting point the idea that the West is a specific, identifiable place. While process scholars attempt to pinpoint the event or time period when the Frontier ceases to be the frontier, the regionalists tell the story of how each individual region was formed and reproduced through diverse cultures interacting with each other and nature. They also believe the frontier process perspective homogenizes individual experiences. In the following chapters about the development of the Internet, I've adapted this concept from Western history to Internet history. Rhetoric at the high, political level conforms to the process orientation. Individual, lived history closely resembles the regional orientation. In the next chapter, I'll provide my conditions for analyzing Internet history as presence of metaphor, idealized values, location of the rhetoric in relation to the history, and the importance of geography.

This analysis primarily draws from this rich body of historiographical articles in *Western Historical Quarterly* to define the parameters of the ideological sects of Western historians. From the 1960s until the 1990s, Turnerians and regionalists debated about the causes of the frontier state, the location of the West, the successiveness of the frontier, and the origin of American values.

In the 1960s, successive rounds of criticism left Western history without a center. Turnerians defended their paradigm against regionalists who saw the Thesis as "nationalistic, simplistic, and hopelessly mired in metaphors of racial and sexual

domination" (Neel 1994, 492). Where Turner was absent, second-generation Turnerians, such as Walter Prescott Webb, author of the classic 1931 study *The Great Plains*, often stood as surrogate whipping boys in the debate. The selected articles from the early 1970s represent Turnerian authors' defenses of their paradigm. Overall, the authors defended Turner's philosophy as imperfect, but seminal. These authors encouraged their peers to ignore the orthodox limitations of the Frontier Thesis and understand Turner in the context of his time and task. In recognizing the limitations of the Frontier Thesis, many Turnerian authors in this era generally did not attack regionalism, rather they called for a centrist approach that used place-orientation as evidence for Turner's "procession of civilization."

Turner biographer Ray Billington was the era's biggest proponent for process-orientation, publishing three articles defending Turner in the early 1970s alone. Malone (1989) asserts that Billington "deserves much of the credit for the endurance of Turner's work" (411). In Billington's 1970 article "The Frontier and I," he recalls the anti-Turnerian sentiment of the late 1930s and 1940s as spurred by the "over-enthusiasm" of Turner's "many disciples" (Billington 1970, 12). The historical profession's negative reaction primarily stemmed from early exaggeration of the frontier's importance to political thought and national identity. The first Turnerians went "far beyond their master in asserting that the frontier was the sole force molding the nation's institutions, not simply one of many" (Billington 1970, 12). Jacobs makes a similar defense from studying Turner's educational and academic background. Engaging the regionalist argument that Turner cites only the frontier as the cause for the nation's identity – the frontier, Jacobs (1970) concludes that Turner conceptualized history as "dynamic and

alive" (369) with multiple causes affecting historical events. In defense of Turner, Young points to a number of locations in the Frontier Thesis that suggest multi-causality including the its mention of abundance of resources, public policy, and Jeffersonian ideals (1970, 150).

Billington engaged regionalists again about whether Turner proliferated the unscientific idea that acquired traits could somehow be inherited. In 1960, Henry E. Huntington Library opened Turner's unpublished correspondence to scholars. Within these documents, Billington found evidence that "the best scientific authority of the day would agree with him that the frontier environment would alter the character of the pioneers" (1970, 14). In this way, Billington pleaded with his peers to understand Turner's work in the context of his scientific environment.

Edgar Pomeroy also encouraged his peers to remove their conceptual straight jackets. "They have run an irregular boundary line about the historical West that sometimes has to pass down the middle of the city streets to avoid the man who does not fit into the formula" (Pomeroy 1955, 579). While this analysis primarily focuses on the far ends of the debate, many historians folded Turnerian concepts into a regionalist format. Occasionally, an author will engage in a regional essay that's positioned around a blind spot of the Frontier Thesis, like when John D.W. Guice writes, "few of Webb's admirers are more devoted than the author … Nevertheless, Webb appeared blind to the antecedents of the cattle kingdom as an industry" (1977, 167). Still, many reputations were made attacking or defending his work and his methodologies, particularly in book reviews, which at a cursory count happened consistently across the eras. Reviewers appear to always make note of the author's position on the political continuum of the

Western history. Occasionally, the reviewer centralizes the entire review as to whether the author takes a Turnerian or regionalist point of view. In the first sentence of an entire review aligning William H. McNeill's *The Great Frontier* within the political continuum of Western history, the reviewer writes: "Between Frederick Jackson Turner and Walter Prescott Webb, William H. McNeill prefers Webb." Engaging the regionalists on the usual battlegrounds, these authors attempted to persuade their peers to ignore the orthodox limitations of the Frontier Thesis and understand Turner's work in context.

The discussions within the frontier and Western historian community in this era took a nearly religious tone. In the 1980s, Martin Ridge claims that most regionalists miss the point. "Most of Turner's critics either challenged specific facts or accused him of the sins of inconsistency, overemphasis, omission, and rhetorical vagueness" (Ridge 1988, 7). The broad stroke of the Frontier Thesis was the embryo of an academic discipline. As Ridge points out, there was no Western history before Turner (1988).

In sum, historians were increasingly hostile toward orthodox Turnerians in the 1930s and 1940s. In the 1960s, successive battles drove the Turnerians and regionalists further away from the centrist view. In the 1970s and early 1980s, neo-Turnerians, chief among them Ray Billington, attempted to contextualize Turner within the milieu of the late 19th century. Facilitated by journals like *The Western Historical Quarterly*, debates like these in the 1960s and 1970s gave the field of Western history vitality. By the late 1980s, *The Western Historical Quarterly* drastically turned down the volume of their navel-gazing. Turner's name disappeared from titles, but consistently remained in footnotes, and then in the 1990s, Turner made a comeback. The journal's winter edition

in 1994 signified a shift toward the "so-called new western historians" – as the articles' authors repeatedly referred to the trend.

In 1994, editors of *The Western Historical Quarterly* invited six historians to respond to David Emmon's "Constructed Province" (1994a) – a treatise that claims the paradoxes of old western history can be "swept away only if we agree to embrace a fixed, uncontested definition of what we mean by 'the West'" (Cronon 1994, 477). Five authors responded to Emmons and then he responded to them all in "In Defense of Subregions and the Imposed Myth" (1994b). In this collection of articles, the authors neither banished nor renewed the Frontier Thesis so much as dissected, qualified, and folded pieces of it into regionalism. Emmons and the responding authors attempted to once again define the boundaries of the West, contextualize the West within larger national and world events, and construct a framework open enough to include minority groups often invisible in western history. In this published debate, these historians solidify the goals of the new paradigm and position the paradigm counter to the Frontier Thesis.

In "Constructed Province," Emmons attempts to divide the American West into analytically stable regions, identify economic and cultural identities for these subregions, and defect from mythology about the source of subregional identity. He asserts that unique economic, geographic, and social forces delineate eight Western subregions: cornbelt West, wheatbelt West, hydraulic West, cattle and sheep West, urban West, corporate/resource extraction West, wageworkers' West, and the Native Americans. In his constructed West, Emmons suggests that geographic determinism is unavoidable in New Western History if it means to distinguish the West and its people (437). Though this closely follows Turner assertion American history was distinct from Europe,

Emmons stops short from the notion that the West ceased being western at the close of the frontier. Emmons' West exists as the result of a complex dialogue with the rest of the nation rather than merely frontier interactions – a key point in his essay.

In "A Place of Extremes: Nature, History, and the American West," Susan Rhoades Neel (1994) less responded to Emmons' article so much as suggested a place for nature and the environment in the new framework: "New western history takes as its starting point the idea that the West is a specific, identifiable place and that western history is properly the story of how that region was formed and reproduced over time through the interaction of diverse cultures with each other and nature" (490). New western history is seen as a counter paradigm to the Frontier Thesis, but Neel also conceded nuanced similarities between Turner's frontier and new western history. Chief among these similarities, Neel emphasized nature as a leading force of change rather than Western's own force upon nature instilling them with certain identities and values. "Who we are, as individuals and as a society, derives from the ways in which we have drawn our physical and spiritual sustenance from the physical world in which we live" (505).

In "The West: A Moving Target," William Cronon (1994) took aim at Emmons most directly. Cronon states that Emmons simply recreated the old issues of successive frontiers typical of Ray Billington, monolithic identities of Turner, and the continuation of the old identity in contemporary times. Though he conceded that Emmons' actors are more diverse than Turner's, "they seem just as white, just as Euroamerican, just as male" (1994, 480). On this point, Yvette Huginnie agreed in "Historical Construction, Multiple Casualties, and the American West." Huginnie called for the pasts of women, Hispanics,

blacks, European immigrants, and Native Americans to play a larger role in the new western paradigm.

Though the responses are critical, they are productive. Turnerians and the new western historians agree on several points: that the West has an eastern edge, the environment affects change on the people and their identity, and the West was constructed as a result of large national and world conditions. Given the perennial usage of the frontier as a metaphor for science and the Internet, I'll use these responses as a framework for the nature of the Internet in the next three chapters. First, I'll maintain that though the Internet might not appear to have physical boundaries, it has contentious spaces. The Internet has both an eastern and western edge in terms of governance, the east and west coasts of the United States. While the environment likely does affect people and their identities as suggested by Cronon, I assert that geography plays a larger role in the origin of the Internet. Finally, just as the West was constructed as a result of large national and world conditions, so was the Internet.

Discussion among Western historians about the Frontier Thesis goes back to 1893 – and the battle spills into many other disciplines as well. American Studies scholar Richard Slotkin traces the full development of the myth of the American frontier in a trilogy, concluding the Frontier is a violent cultural device. Political scientists and historians alike lament that Turner's philosophy has been seized upon to exercise totalitarian government planning (Rundbell 1959). Scholars of rhetoric consider the Turnerian frontier as a problematic metaphor (Ceccarelli 2013). Politicians wield the Thesis as a rhetorical device with varying levels of success (Dorsey 1995; Jordan 2003;

Bush 1945; Opt 1996). Indeed, the frontier is a problematic symbol, yet remarkably resilient in the face of criticism.

The broad stroke of the Frontier Thesis was the embryo of an academic discipline, just as the broad stroke of Bush's *Science: The Endless Frontier*, and Kennedy's New Frontier created and implemented the contemporary framework for publicly funded science. Similarly, government agencies like ARPA that funded high-risk, high-reward research grew out of the rhetoric of the frontier as applied to science. The Turner debate shows that myth can become history and history can become myth. The mythic history, or the Turnerian point of view, distills the national identity into a value-laden archetype and explains the existence of those values based on environmental factors. As early as the 1950s historians like Pomeroy (1955) asserted that his peers should take Turner in context, making the point that Turner was as a good a salesman as a historian. Pomeroy maintains that, yes, Turner's writing was soaring in concept and rhetoric, but also reminds that "the prophet was less orthodox than the priesthood" (599). The same could be true about Bush, Licklider, or Kennedy and their future disciples.

CHAPTER III

THE ENDLESS FRONTIER OF SCIENCE

Though the men and women who created the Internet worked in a system created by rhetoric replete with frontier heroes, conquistadors, and villains, they themselves didn't necessary live to the values and character created by the persistent mythology. According to dominant frontier rhetoric, to be a good frontiersman, then it's necessary to explore the unknown with the courage of an explorer, breaking trails to reap the rewards of new opportunities. Interaction with wild, unknown spaces developed character of the pioneer, instilling the pioneer with values that informed their cultural identity. This, of course, is a useful myth.

Rather than pioneers driven by romantic, expansionist goals, the people who worked at these places of Internet history simply applied their technical skills and knowledge toward a technological goal. In the case of Vint Cerf and Bob Kahn, it meant attempting to find an efficient packet switching solution that would allow computers to talk with one another in a network. For Joe Postel, the silent hero among the pioneers of Internet history, it meant maintaining a collaborative environment among science stakeholders with the CFPs. Within the rhetoric of science, they are the heroes who "have the rare capacity to hear the one everlasting whisper" and trudge singularly into the wilderness. In actuality these individuals were agents of technological innovation they could only maintain in collaborative environments that privileged intellectual freedom and open discourse. They improved upon technology to which thousands of other scientists already contributed in similar environments across the country – and the world. The disparity between hero scientists and the collaborative scientific community is

among the primary differences between the frontier of science mythology and the reality of the historic moments.

There are key differences between the histories created by Internet regionalists and Turnerians. Both sides, however, contextualize historical events. The regionalists look at how the story of the Internet was formed and reproduced through government-private corporations interacting with each other. The Internet Turnerians might understand the Internet as a regional landscape, but its creation epitomizes a single moment of conception in rhetoric and then reproduced the values portrayed by heroes in successive waves of innovation. Harkening back to the intellectual development of Western history, these differences can be expressed in the presence of metaphor, values associated with their idealized pasts and futures, location of the rhetoric in relation to the history, and the importance of geography.

First, the presence of the frontier metaphor or its subordinate metaphors is particularly telling in the orientation of a story. Internet regionalists typically avoid the use of metaphors, neutralize the Frontier Thesis metaphor, or position themselves against process orientation. The metaphor is problematic in its determinism and emphasis on individual contributions rather than an effort of a group in technological succession. Internet historians largely embody a regionalist perspective. Internet Turnerians, however, employ the metaphor of the Frontier in process-oriented rhetoric for a public audience. In sum, the Frontier Thesis is most effective for public rhetoric and discourse, and largely absent in historical accounts and communication intended for consumption by internal, expert stakeholders.

Second, place-orientation traditionally arises after process-orientation. "Each age writes the history of the past anew with reference to the conditions uppermost in its own time," said Frederick Jackson Turner (Williams 1955). Process-oriented rhetoric persuades public stakeholders to support scientific activity. Place-oriented accounts follow knowledge creation and innovation within the context of collaboration. Just as the technologies in question did not spring into the world fully formed, neither did the heroes of the Frontier Thesis or the frontier of science. Process heroes are the key figures for these origin myths because they exemplify desirable traits and values associated with the rhetor's ideology. Place historians promote groups of individuals as they interact within a human or natural ecosystem, taking into account their relationships to ancestral technological epochs and sociotechnical systems. In sum, place-oriented history takes into account multiple causes for an event or series of events, and process-oriented rhetoric tends to single out a particular cause for an event in order to persuade.

Third, despite their differences both place-oriented history and process rhetoric are deterministic. The premise of regionalism is that a place's geography makes it specific. Within the various agencies, subcultures positioned their identity against the monolithic corporations and governments. To say that government officials allowed the small groups of researchers to create their culture with the machinations of big government is deterministic, but it's determinisitic in a different way than the mythopoeic heroes of process-oriented rhetoric. Process myths articulate the future according to the values established by its narrative as exemplified by the hero. These myths create their own mythopoeic universe to serve a larger purpose. Place histories reinforce the role of a

collaborative scientific community, drawing attention away from the individuals lofted to pedestals in rhetoric and contextualizing their roles in the community of scientists.

Finally, Geography very much plays a role in the history of the Internet. First, geography and communication always coexist. Technological epochs are defined by the speed at which information travels. With the telegraph, information could for the first time travel faster than the fastest transportation of the time. Second, the Internet was born in the West, which became the place of scientific research in the 1940s. Old frontier states became the ground zero for a technological explosion during the Atomic Age. In sum, geography matters.

The history of the Internet starts at the intersection of the Atomic Age and computing. In November 1942, J. Robert Oppenheimer visited the Los Alamos Boys' School with Manhattan Project director General Leslie Groves to determine whether the small school complex near Otowi, New Mexico, could serve as the secret laboratory where his team would build an atomic bomb. Despite disagreeing quite regularly about manpower requirements, resources, and personnel structure, the men agreed both on the location of the site and the need for the secret work to be centralized. In the early months of 1943, Leo Szilard, Richard Feynman, Neils Bohr, Edward Teller, Oppenheimer and other physicists moved with their families into the militarized facility to continue work on the bomb.

Historian Mark Fiege characterizes Groves as a staunch utilitarian with a rigid, disciplined lifestyle and a reputation for getting things done. Before becoming director of the Manhattan Project, he worked as the manager for the construction of the Pentagon and other massive Army Corps of Engineer projects both stateside and abroad. His new

mission was significantly bigger even than building the largest office building in the world. Ninety percent of the Manhattan Project costs came from constructing bomb-making facilities in three states, including the first industrial grade plutonium plant in Hanford, Washington, and employing 125,000 men. Logistically, he was well fit to win the war of the atom, but among his greatest challenges was managing the scientists at the small complex in Los Alamos.

Rigid military structure and science didn't initially mix at Los Alamos. Oppenheimer's scientists required free inquiry, open communication, and debate. They encouraged intellectual openness and actively resisted the military demands for efficiency and command hierarchy. Groves often treated the scientists like his junior officers, initially even wanting to commission the scientists as Army Corps Engineer officers, but the researchers declined. The scientists remained civilian employees, but also underwent constant surveillance and censorship in their town on the mesa. "Ultimately, Los Alamos became a site of collaboration and compromise between the atomic scientists and the Army Corps of Engineers" (Fiege 2012, 296). In Groves' estimation, these engineers could build the bomb, win the war, "which to him continued America's conquest of the frontier" (Fiege 2012, 293). In this way, Groves' conception of the frontier merged with Oppenheimer's who followed Bush's notion that the next frontier was knowledge. So, in the end, the scientists and military co-existed, allowing the scientists an open, informal space for scientific process and intellectual freedom within the machinations of the military. The military funded science without interfering with the process of science, even though militarizing scientific knowledge itself was antithetical to the values of the largely humanitarian scientists. The scientists, however, feared the Germans might

develop the bomb first. They joined the strict life within their compound to collaborate and expand the knowledge of their field with nearly unlimited resources from the federal government. Nobel Laureate Niels Bohr, though initially ambivalent about the project, eventually embraced the work:

> "Not only would the bomb establish peace, Bohr believed, but controlling it would require the nations of the Earth to create an 'open world' in which they must share scientific knowledge for the betterment of all. The only question was whether the bomb had enough sheer might to produce this outcome" (in Fiege 2012, 299).

On July 16, 1945, Bohr and the other scientists first experienced the "sheer might" of the first atomic explosion. Behind a blast wall, ten miles from Ground Zero, Vannevar Bush, Groves, Oppenheimer and his team, listened to physicist Samuel Allison count down to zero over a loudspeaker. They nervously joked in the bunker, considering the possibility that a miscalculation might send a ball of hyper-heated air into their safe viewing area, or potentially igniting the Earth's atmosphere. At zero, a burst of filled the sky. A fireball mushroomed 41,000 feet into the sub-stratosphere. Shock and sound waves shot away from the blast. They calculated correctly. Safe from the immediate blast, they brought into existence a technology that changed the world. Though the project might encourage nations to share scientific knowledge, it became clear that controlling the bomb for peace meant something different for Americans than the rest of the world. "Intelligence on the American bomb hurtled Soviet and American leaders toward postwar rivalries on the cusp of their joint victory" (Brown 2013, 81).

In the buildup to the bombings of Hiroshima and Nagasaki three weeks later, President Roosevelt revealed the bomb's success to the leaders of ally countries, including Joseph Stalin. Truman hoped to see "fear or new respect on the Soviet leader's

face" (Brown 2013, 81). Stalin, however, remained unvexed. He had known about the Manhattan Project since 1942. At the moment of the reveal, Stalin had teams of researchers scouting locations for the first Soviet plutonium plant. In the spring of 1945, Soviet agents covertly obtained the Smyth Report, the official history of the Manhattan Project and blueprint for the Soviet atomic project. Four years later, the Soviet Union tested their first nuclear weapon, an event that Moscow propagandists welcomed as the "peaceful atom." "Soviet citizens believed their bomb was not a weapon of destruction but a 'nuclear shield' against capitalist aggression" (Brown 2013, 133).

When Bohr posited that the "sheer might" of the bomb would create an "open world," he likely didn't consider the development of the Internet, but ostensibly this was the case. Despite some scholars' assertions that ARPANET was not developed to decentralize communication to missile silos in the event of a nuclear war, the myth is rooted in truth. The early networking research at ARPA was funded in the post-WWII scientific community detailed in Bush's *Science: The Endless Frontier* alongside Kennedy's call for science in the New Frontier.

Whether he liked it or not, which he didn't, Bush was the architect for the military industrial complex. "Today, everyone thinks these terrific innovations came from the minds of bright kids, but they don't realize that these kids needed an environment to be in. It came from Bush. He said, 'Give these people money, let them play, and they'll come up with something," wrote Bush biographer Zachary Pascal. To examine ARPANET, it's important to understand the Bush's influences on the post-WWII scientific community, Bush's conceptions for the funding science with federal money, and the rhetoric he used in *Science: The Endless Frontier*.

When World War II ended, the OSDR was “an unclean thing” despite its technological successes (Reingold 1987, 234). It had to go. In reconfiguring the U.S. economy and society from fighting a total war to a peaceful body, the federal government needed to find a new place for the science and scientists that arguably helped win the war. With the military branches engorged with resources and personnel, branch commanders hardly wanted to downsize and definitely didn’t want to stop the science that created radar, napalm, proximity fuses, and the atomic bomb. During the war, OSDR had nearly complete control over basic and applied science research in the United States.

Defense contractors on the largest wartime projects found themselves awash in nearly unlimited government funding. Similarly, traditionally underfunded departments in universities used their skillsets to do the ‘big science’ that only governments might be able to bankroll. Often they did both, teaming contractors and first-class academic institutions to set the top minds on important war-related technology research. At its peak, the OSRD employed more than 6,000 scientists who worked with the military in a client-like capacity. Though Bush was distrustful of contractors and politicians, he recognized their role in the wartime OSDR machine. However, with the end of the war, the OSDR needed to split its research divisions and turn them over to new management. The newly created Atomic Energy Commission and Naval Research Laboratory took over further development of nuclear assets, and other weapons programs transferred to defense contractors and military research agencies. Bush welcomed the dismantling of the OSDR, primarily seeing it as a necessary political and structural opening for massive reform of publicly funded basic and applied scientific research (Reingold 1987). Bush advocated strongly for increased funding for small-scale university research programs, reformed

university curricula in math, science, and medicine, reduced interference in scientific policy by politicians, establishing a lead scientist role in government autonomous of Congress and the President, and the creation of the lead scientist's organization, the National Science Foundation. In 1945, Vannevar Bush, in his perfunctory role as the nation's first scientific advisor to the president, submitted to the executive office a 252-page *Science: The Endless Frontier*, which mapped out the peacetime mission and structure of the federally funded scientific community.

Bush was concerned that science and innovation would decline after the war if the government cut funding to universities. "Only the federal government had the money to pay the bill for world-class research," wrote Bush (Zachary 1997, 218). Bush had three main goals for the post-war scientific community: guarantee adequate funding for basic and applied research, improve the quality of the military's research, and apply scientific expertise in the areas of education, research, and military. Central to this vision was an independently appointed chairman for the National Science Foundation who would only be accountable to a panel of scientists on the National Science Board. He envisioned an apolitical, scientific governing body as the only ones capable of directing federal research funds, which he wrote into his recommendations. Unfortunately, "Truman would not approve an organization whose director he could not hire or fire," believing the position to be unconstitutional.

Informed by the organizational and operational success of the Office of Science and Research Development, Bush's recommendations for the post-WWII scientific community embraced knowledge as a source for American freedom and innovation. In *Science: The Endless Frontier*, Bush develops a mythological America where knowledge

was the source for freedom, and science and technology was the implement to extract knowledge from the physical and social worlds. Scientists and engineers would be the heroes for the new generation. In *The Endless Frontier*, Bush uses process-oriented rhetoric lifted directly from Turner's Frontier Thesis.

Directly referencing the Homestead Act of 1862, Bush (1945) equates federal funding for scientific research as necessary and productive, furnishing "land for pioneers" in the "opening of new frontiers" (8). The wartime OSDR opened science as a wilderness and the National Science Foundation was the successive frontier. With the successive metaphorical frontier come values associated with the advance of American science. Just as Turner's frontier heroes attain their values from living near the wilderness, scientists similarly attain their values. In claiming that scientists and engineers are heroes, he's saying that their values are associated with their interaction with the "scientific wilderness." Rather than rugged individualism, the new pioneer heroes prescribe to a value system of community, openness, and collaboration. Bush continues in the report that "it is in keeping with the American tradition – one which had made the United States great – that new frontiers shall be made accessible for development by all American citizens" (11). Most importantly, scientists, not politicians, would win Bush's frontier.

The Senate passed the National Science Foundation Act of 1947, but Truman vetoed the bill claiming that its administrators were not appropriately responsible to Congress or the President (Zachary 1997). Bush considered the constitutional objection bogus, pointing to the administration of NASA as a functioning example of an expert at the reigns of a research agency. "Truman's vote destroyed Bush's hope that a research foundation would soon replace the military as the chief patron of academic science"

(Zachary 1997, 333). Without a successor organization, Congress ceased funding to the OSRD in 1947 and its projects were split between the Office of Naval Research and the Atomic Energy Commission. With the dismantling of the parent organization of the Manhattan Project, the AEC assumed control over the Project's facilities, marking the birth of the National Laboratory system and a new structure for basic science in the United States. Largely relegated in their research roles, the military took substantial control over orphaned research funding.

After five more years of wrangling in Congress, Truman signed the law creating the National Science Foundation. Bush's endless frontier, however, was ended as infinite only for the lobbyists. The OSDR was a war-borne behemoth intended only to last as long as the war. *Science: The Endless Frontier* intended to separate military from science, and science from politics. The result: a marriage of science, military, and corporations forged in law. Though Bush's initial idea was not fully initiated, to this day "hardly a word is written about science policy today without making reference to Bush and his report" (Ceccarelli 2013, 41). Bush's frontier left science to the scientists while calling on industry to create the technology that would assist the scientists. In the end, the military-academia-industrial complex became the status quo for research and development in the United States. The Manhattan Project didn't necessarily stem from a particular instance of frontier rhetoric, but it greatly informed the structure and goals of the post-WWII scientific community as envisioned in the *Science: The Endless Frontier*.

When Turner looked at the 1890 Census Report, he notes the "uneven advance of the farmer's frontier, with tongues of settlement pushed forward" (Turner 2013, 12). In addition to the fertility of certain regions and ease of travel along geological features such

as rivers and valleys, he also mentions the frontier army post. “The frontier army post, serving to protect the settlers from Indians, has also acted as a wedge to open the Indian country, and has been a nucleus of settlement” (Turner 2013, 13). Federal land still plays a large role in the “frontier of science,” and the frontier metaphor played a significant role in the creation of the federal lands used for military and science.

Starting as early as the mid-nineteenth century with calls by Romantic poet Henry David Thoreau to protect the wild places, and fully enflamed by the 1890s, the use of America’s massive tracts of public land created a schism in national discourse (R. Nash 2001). On one side, led by the famous naturalist John Muir and the Sierra Club, the preservationists advocated for reserves of land unaltered by man. On the other side, conservationists called for planned development of resources. “Juxtaposing the needs of civilization with the spiritual and aesthetic value of wilderness, the conservation issue extended the old dialogue between pioneers and Romantics” (R. Nash 2001, 129). Teddy Roosevelt pulled heavily from the frontier myth and its values in supporting the conservation movement that eventually led to legislation that established the nation’s first federal wildlife refuge, five national parks, and eighteen national monuments (Dorsey 1995). Facing this major divide in public opinion and needing broad public support to drive legislation through an uncooperative Congress, Roosevelt’s rhetoric from 1901 to 1909 balanced saving scenic areas of the country with industrial interests to harvest minerals, lumber, and energy, and preservation. In order to serve his political purposes, Roosevelt altered the traditional Frontier Myth in three ways: replacing the traditional “violent and exploitative” pioneer with the “farmer-hero,” redefining the unlimited frontier to a finite environment, and revised individual progress as resulting from

community rather than individual efforts (Dorsey 1995, 3). In his rhetoric, the characteristics of the hero changed. Unlimited space implies conquest (Jordan 2003), but finite, cherished land requires defense. Thus, the narrative changed from the destructive actions of the traditionally lone, industrious frontiersman to the collective effort to cherish and protect something finite. The resulting legislation resulted in the authorization of $80 million for the reclamation of three million acres of land. Though a relatively small authorization in funds, equivalent to approximately $2 billion 2014 dollars, Roosevelt's work toward conservation resulted directly in the establishment of the U.S. Forestry Service as it exists today, which manages 193 million acres of federally owned land. While Roosevelt did not create the National Park Service, he enacted the Antiquities Act of 1906, the original authority for about a quarter of the 401 areas comprising the national park system, which encompasses 84 million acres. Less than forty years later, in the face of a total war, the U.S. government overtook land under eminent domain and fair-value purchases for military and research installations.

The rhetoric of *Science: The Endless Frontier* lends itself to a successive Western frontier, manifesting itself as massive consolidation of Western land for large-scale federal science projects during and after the war. Science served to subsidize the Western states. "Before 1940 many westerners believed that economic opportunities in the West had come to an end. President Roosevelt himself in 1935 had expressed the belief that the frontier had ceased to exist and that further growth in the West was unlikely" (Nash 1999, 54). Hanford Site, near Richland, Washington, was the location for the first industrial-scale plutonium plant in the world. At its peak as an "Atomic Frontier" site, the Tricities area near Richland, Washington, boasted 60,000 people. In the nuclear weapon build up

of the Cold War, the communities surrounding the Hanford Plant boasted 60,000 people in a city built completely by the U.S. government to attract top engineers and managers. Even after it closed in the 1990s, Hanford still employs 25,000 people in the area to clean up the largest nuclear wasteland in the country. The Department of Energy expects to spend $100 billion on the site in the next ten years. Sandia National Laboratory in Albuquerque, New Mexico, developed, tested, and tested the non-nuclear parts of the nuclear weapon. White Sands Missile range is still the largest military installation in the United States, encompassing 3,600 square miles of New Mexico desert, and employing 3,000 people in the otherwise industrial region. These are only the facilities directly linked to the Manhattan Project, not the hundreds of military installations that serve as the economic basis for local communities in the West.

Similarly, geography dictated the location of the Hanford Site. The site and natural features were as much a part of the machinery of the plant as the reactors. Manhattan Project engineers selected the Hanford Site, near Richland, Washington, for its geographic features, isolation from major urban centers, and proximity to abundant electricity. Not many places fit the stringent criteria for a massive, secret facility, but General Groves found his perfect site in Washington. Only occupied by 2,000 people, the 670-square-mile site was isolated and easy to clear of people. Once the owners of unproductive farms were evicted, the area was safe in case of accident and also secret. The barren location was windy, which engineers initially thought would allow dispersal of airborne radioactive material across a wide enough area to be harmless (Brown 2013). Located beside the Columbia River, engineers believed the river would appropriately dilute and disperse radioactive waste generated by the plant. River water used to cool the

reactor flowed into the reactor at the rate of 40,000 gallons per day, exiting the apparatus into a cooling pond that fed back into the Columbia River (Brown 2013). For abundant electricity, Hanford came out of another larger, earlier federal project – the Columbia River Basin project and the Grand Coulee Dam hydroelectric generation station. In this way, the landscape became part of the plant's machinery. In the time of urgent wartime need, Manhattan Project managers selected the site based on unsubstantiated assumptions and once the river and atmosphere became part of the production process, the natural features would be part of the machinery of the plant until the need was fulfilled. The West's ecosystem, however, could not fully dilute the wastes created while producing the material for nuclear weapons, creating a larger issue as the population density around the plant increased. "Even if the West had been truly empty, however, federal bomb making would have made sure that it did not stay that way, because nuclear weapons facilities accelerated the urbanization and the industrialization of the region" (Findlay 2011, 3899).

Roosevelt's legislation created the cherished national park system – and also supported the conservation movement. With its abundance of cheap land and open space, the West was ideal for the large-scale technology and research projects of the 1940s. Much of the space was federally owned, so the government either transferred the land to science or purchased the land cheaply from farmers and ranchers. The West is an analog to the government creating a new platform for communication and commerce.

CHAPTER IV

THE TECHNOLOGICAL WAR OF THE NEW FRONTIER

The Frontier Myth is absent from the early history of the Internet despite its development and growth in the post-WWII scientific community championed by Bush's *Endless Frontier*, directly linked to Cold War military weapons system, and informed by the Kennedy administration's New Frontier. The highly technical and research-related quality of ARPANET neither wanted nor required the public's support; therefore, stakeholders had no use for the Frontier Myth. ARPANET engineers and policy makers didn't create the so-called frontier. They opened up a metaphorical wilderness in the endless frontier of science. Internal rhetoric surrounding ARPANET emphasized "new territories," indicating a neutralized space for potential commercial or military internal use. This chapter is premised on the idea that the New Frontier rhetoric opened up new funding for scientific research in the United States. In this chapter I'll show how collaborative engineers in a small field created a resilient, survivable network for the military and then instilled the system with their own collaborative values.

On July 15, 1960, John F. Kennedy addressed the Democratic National Convention as the party's nominee for the presidential race. Before the 20,000 people at the Denver Convention Center, he introduced the narrative for his presidential campaign, presidency, and the direction of the nation.

> We stand today on the edge of a New Frontier — the frontier of 1960s, the frontier of unknown opportunities and perils, the frontier of unfilled hopes and unfilled threats. ... Beyond that frontier are uncharted areas of science and space, unsolved problems of peace and war, unconquered problems of ignorance and prejudice, unanswered questions of poverty and surplus (Kennedy 1960).

On May 25, 1961, John F. Kennedy stood before Congress as president and asked the nation to make its largest peacetime commitment of national resources to a single technological feat – the first manned mission to the moon, and the breakthrough into the "new frontier." In establishing the groundwork to access his "New Frontier," Kennedy invoked a deeply engrained American nationalism tied to images symbolic of overcoming obstacles and conquering the unknown with tenacity, technology, and spirited individualism – familiar heroes of the pioneer era, navigation terms associated with Westward expansion, and even Manifest Destiny itself.

As the Cold War raged in technological one-upmanship, Kennedy announced his moonshot plan in the "Special Message to the Congress on Urgent Needs" on May 25, 1961. In this address to Congress, Kennedy returns to the original Frontier Thesis archetypal heroes, while also altering the universe and narrative to encourage public support for his space initiative. First, Kennedy shifted the frontier from the infinite to the finite, Kennedy bought the moon within tangible grasp using familiar navigation terms and spatial progressions, which "enabled Kennedy to dismiss questions about practically of the mission as being contrary to our national character" (Jordan 2003, 216). Evincing a brand of Manifest Destiny, Kennedy also manipulated time toward inevitability, urgency, and perseverance. Though the Russians already minorly occupied space, America would over a decade make it to the moon.

Kennedy crafted a public role in the exploration of space, "creating a perspective in which the audience could see themselves as the next in a long line of pioneers" (Jordan 2003, 210). Ultimately, the heroes in Kennedy's moonshot speech were the astronauts who would physically travel the "vast stretches" of space, the scientists who would

provide the solutions and completion to innovations that were "unanswered and unfinished" (Jordan 2003, 212). Kennedy's rhetoric not only created a new frontier for the public, but also a participatory experience on the national road to the moon landing. In response to the presidential request and public support, Congress authorized the largest commitment of resources to a single technological feat ever made– $33.4 billion from 1959 to 1969 including $26 billion for research and development (Ezell 1988, 8–10).

Kennedy linked the frontier to a process already underway. In 1958, President Eisenhower requested a $520 million appropriation from Congress and a $2 billion budget plan for the Advanced Research Project Agency to direct "all U.S. space programs and all advanced strategic missile research" (Hafner and Lyon 1998, 20). Congress approved the funding five days after Eisenhower appointed Roy Johnson, vice president of General Electric, to the helm. ARPA was set to contribute to the core of American global power – delivery systems for nuclear weapons, smaller bombs with higher yields, and nuclear early warning systems, but only for a short time. Hastily founded as an "interim space agency" in the aftermath of the 1957 Sputnik launch, ARPA served as holding tank for civilian and military assets. (Edwards 1997). In 1958, Eisenhower signed into law the National Aeronautics and Space Administration, stripping ARPA of its space mission and leaving the fledgling agency with a fraction of its original budget. Facing failure before launch, ARPA repositioned itself as the federal space for high-risk, high-gain research. They intended to distance themselves from the Pentagon, push near-term goals, and tap top-tier research universities for talent. In short, ARPA's strategy was to always swing for the fences and do so conforming to Bush's original conception of the scientific community. As enacted, the policies derived from

Bush's *Endless Frontier* ultimately placed too much power over science policy in the hands of politicians. ARPA was an enclave for researchers to manage big science without much oversight from the Pentagon. The new organization was ideally suited to the atmospheric change in Washington that came with Kennedy's administration and the New Frontier – a frontier that would need computing power to fulfill its goals.

Kennedy's political motives manifested as funding for computing. Within ARPA, computing fell to the laboratory of Command and Control Research. Then as now command and control warfare comprised military tactics that use technology and techniques to deceive the enemy, jam enemy transmission, and ensure efficient, reliable communication for friendly troops. Most importantly, the military wanted to replace human skill for computing power. The Cold War was a conflict that employed high technology weapons systems that were beyond a human's ability to control without computers. Interpreted from the military point of view, Licklider's 1960 paper "Man-Human Symbiosis" meant computers aiming and operating advanced weapons, solving difficult problems in weapons engineering, and calculating increasingly complicated operational war-game scenarios. In the immediate postwar years, federal research funds for computer development primarily came from military agencies. Kenneth Flamm estimates that the federal government funded 80 to 85 percent of computer research in 1950 (Edwards 1997). It might seem that as long as the military funded computer research, they could dictate the values associated with the technology. Though it might be true that researchers contributed to General Westmoreland's "electronic battlefield, in other cases, researchers hijacked the programs, instilling them with their own values.

Licklider became the first director of ARPA's Command and Control Research laboratory in October 1962, shifting the focus of the program that would eventually carry out his vision for computing. He was offered the position after he published his foundational paper and became known for his work on psychoacoustics and human-computer interactions for the Air Force. When Licklider took the reins, the office had a $5 million budget in addition to a single $9 million contract with System Development Corporation for the IBM-built AN/FSQ-32 computer – a prototype mainframe computer intended to power a system of radar sites to control NORAD response to a Soviet air strike. Immediately, Licklider reached out to computer scientists at Stanford, MIT, UCLA, Berkeley, and SDC allocating research dollars into time- and resource-sharing, operating systems, artificial intelligence, and computer graphics. He also changed the name of the laboratory to the Information Processing Techniques Office (IPTO), representing a shift from ambitious, yet impractical military tasks, to a value-based mission closer to his vision of man-computer symbiosis.

In the 1960s, a problem still existed within the collection of ARPA-owned computers that they were custom-built to specific tasks. Without standardization, each computer relied on a unique programming language. Across the ARPA-funded collection of computers, researchers were duplicating and isolating computing resources. If a scientist needed to solve a problem, he would need to physically travel to the computer and work with a programmer to run their computation. The problem was as much geographic as technological. At a series of computer seminars at the Pentagon in 1962, Licklider ardently pitched time-sharing as a solution. Each computer purchased by the government should be accessible over a network, he said, so that one computer may serve

many different users. His first year as IPTO director, Licklider funded a $2 million time-sharing project at MIT called Project MAC where 30 users could simultaneously share a mainframe computer. MAC stood for Man and Computer, Machine-Aided Cognition, or Multi-Access Computing, depending on the individual's preferred backronym. "Licklider's goal was not simply to develop time-sharing but also to develop a community of researchers who would make the new machine a central part of their investigations" ("Defense Advanced Research Projects Agency (DARPA) | United States Government" 2015). He also famously wrote a series of memos in support of a global computer network, calling it the "Intergalactic Computer Network," which would facilitate military goals and also collaboration among a community of researchers. Computers networked to the eventual ARPANET could reach out to resources in other computers, reflecting the collaborative community of scientists.

New ideas about command systems emerged independently from different agencies within the military-industrial complex. The RAND Corporation established itself after the war as a leading defense contractor researching tactics and operations, essentially privatizing functions the OSDR developed during the war (Hafner and Lyon 1998, 55). The U.S. Army Air Forces established Project RAND in 1945 to plan the long-term future of weapons systems. Two years later, RAND Corporation split from its parent company Douglas Aircraft Company to become an independent, non-profit research organization. In the 1950s, RAND Corporation found their place in systems analysis research for artificial intelligence, space systems and war-gaming. In the 1960s, RAND engineer Paul Baran significantly contributed two main ideas to the theories of network survivability that would serve as the framework for the Internet. Primarily motivated by

the tensions between the U.S. and Soviet Union, Baran developed an interest in the survivability of essential communication systems for the President to initiate a retaliatory nuclear attack. Baran's findings at RAND showed the U.S. long-distance telecommunication system was particularly vulnerable to failure in the event of an attack solely based on its centralized network configuration. Baran envisioned a network as an interconnected set of nodes, each having the ability to send and receive data. He cites three types of networks, listed in order of vulnerability. When diagramed, centralized networks look like the spokes in a bicycle wheel where all outer connections meet at a center node. If the central point fails, then communication fails for all perimeter points. Decentralized networks operate linking the hub of centralized networks to one another. If the links between spokes breaks, then it would partition the network. Finally, distributed networks most closely resemble a fishnet with many interconnected neighboring nodes. If one or more nodes fail in a distributed network, transmissions can be rerouted around the failure in any open direction. Telephone networks have always been configured either as centralized or decentralized networks. All telephony networks route users through local central switching points that relay the signal long transmission lines to another local switching point and finally to the other user, with several relays in between. In the event of a nuclear strike or other outage, failure of main switching points could hobble the entire network because there were no redundancies. Baran concluded that wartime communication systems should employ three to four redundancies to develop sufficient reliability and ruggedness. In the event of a nuclear strike, pathways would still exist in a distributed network. His second idea was to break apart the message into smaller pieces for transmission. At the time, user-to-user long distance connections kept all the circuits

open for the duration of the call. Rather than establishing and maintaining a dedicated pathway, Baran's message would separate into "blocks." These separate blocks would be uniform in size, take different routes from origin to destination, and allow a constant flow of data from many different sources to enter the transmission line at the same time. Hafner and Lyon use the example of transporting a house from Boston to Los Angeles. Engineers could potentially load the entire house onto the back of a truck in one piece, but with great difficulty. Instead, they would most likely dissemble the house, label the pieces to indicate their location in the overall structure, and load the pieces onto trucks. Not every truck would necessarily take the same cross-country route as they reroute for efficiency, bad traffic, or adverse weather, but once all the pieces arrive engineers could reassemble the structure on its new lot in California. Conceptually, Baran said the same thing could be done with information. A computer could break the message into pieces, label each individual section according to its order in the whole message, and transmit them through the quickest available route. Each switching node would have a routing table that indicated the best route to take, constantly updating with information about neighboring nodes, distances, and delays. Also known as dynamic routing, Baran called the scheme "hot potato routing." If the best path were busy or missing, then the table would reroute to the next best route, or even send the block back to the originating node. At the receiving end, another computer would look at the labels and reassemble the message in the correct order.

In 1965, after failing to convince AT&T its system was vulnerable to attack, Baran sent a formal recommendation to the Air Force to develop an experimental network: "The need for a survivable … flexible, user-to-user communications system is

of overriding importance" (Hafner and Lyon 1998, 64). Despite the Air Force agreeing to fund the network, AT&T still refused to build or maintain the system. Not to be dissuaded, the Pentagon ventured to build the network with the newly formed Defense Communication Agency at the helm rather the Air Force, but Baran moved to halt the work. "It would have been a damn waste of government money and set things back. The DCA would screw it up and then no else would be allowed to try, given the failed attempt on the books" (Hafner and Lyon 1998, 64). Determined to wait for the right agency to undertake the project, Baran shelved his message-blocking concept around the same time British physicist Donald Davies at the National Physical Laboratory floated a similar idea to the British Post Office for their telephony network. He, too, faced stiff opposition from the telephone monopoly.

In 1965, Davies wrote a series of personal notes to colleagues about splitting messages into uniform data "packets" after observing MIT's Project MAC time-sharing system (Hafner and Lyon 1998). The word packet in itself was a deliberate metaphor representing a small package. "I thought it was important to have a new word for one for the short pieces of data which traveled separately" (Hafner and Lyon 1998, 67). After asking two linguists whether there were cognates in other languages, he fixed the term "packet switching." The phrase was much more palatable than Baran's "distributed adaptive message block switching" idea, but the two essentially meant the same thing. Only one primary difference separated their research. Davies focused on configuring the packets to overcome differences in computer language, hardware, and software. He envisioned a global network of computers connected by intermediary computers. ARPA's principal investigators would independently come to the same conclusion after a

1967 meeting in Ann Arbor, Michigan – a watershed moment in the history of computing that provided researchers to develop the experimental network with a set of values that mirrored their community.

Though Licklider left ARPA within two years of arriving, he built a highly qualified computer science team with vision for the future of interactive computing, and the promise for continued funding. Ivan Sutherland succeeded Licklider, but then left after only a few months later, leaving for a position at Harvard. Computer scientist Bob Taylor moved from the deputy position at IPTO to become the lab's third director in 1966. Having moved from NASA to work with Licklider, Taylor followed the doctrine of "Man-Human Symbiosis," instating the values of collaboration into the network experiment he would devise and fund. ARPA director Charles Herzfeld was renowned for easily funding project, so much so that a joke among project directors was: "Come up with a good idea for a research program and it will take you about 30 minutes to get it funded" (Hafner and Lyon 1998, 41). With the floodgates of New Frontier funding open and in the spirit of the Endless Frontier, Herzfeld funded the experimental network, but finding a project manager proved difficult for Taylor. In some cases, researchers were happy working at their respective institutions. In other cases, researchers simply didn't want to be part of defense research, even though much of computing research was funded by the Department of Defense. Taylor immediately pursued MIT Lincoln Lab scientist Larry Roberts, promising not only sufficient funding for the project, but also the directorship of IPTO when he left. Roberts, however, employed both techniques for rejecting the offer, insisting he liked his work in Boston and also didn't want to become a Washington bureaucrat. After three visits to Boston and a year of rejection, Taylor found

out that more than half of Lincoln Lab's funding came from ARPA. Approaching ARPA director Herzfeld, Taylor asked him to call the Lincoln Lab director and inform him that the on-going support of the lab would be conditional on with Larry Roberts heading the ARPANET project. Three weeks later, Roberts joined ARPA from Lincoln Lab in 1966 to headed to Washington.

As Kennedy linked the American scientific frontier to facing down "the single-minded advance of the Communist system," Taylor networked computers to face down researchers who each wanted their own computer. Following Licklider's time-sharing philosophy, Taylor saw computers isolated in labs across country as a waste of money and resources. Though Licklider's philosophy manifested with in the community as a zeal for elevating computers beyond the role of expensive calculators, researchers still viewed time-sharing as depleting already-thin resources. Many researchers did not initially embrace the idea, which was evident in a meeting at the University of Michigan in Ann Arbor in 1967 to layout the networking experiment. Speed, reliability and mapping were among the main issues discussed at that meeting. Each researcher turned complaints into value-laden requirements for the network. The scientists agreed that extant time-sharing systems were excruciatingly slow and notoriously unreliable with transmitting data. They noted that the network should have a fast response time, agreeing on a basic benchmark of half a second. The researchers were frustrated with failed attempts at transmitting data as circuits closed and dumped the connection, but the telephone system was ill suited for sustained long connections. Taylor proposed using modems to network the computers. Research led by Roberts in 1966 linked his computer at Lincoln Lab with the SD Q-32 in Santa Monica, but the crude modems, referred to as

"automatic dialers" operated at 2,000 bits per second and required special four-wire Western Union lines. They obviously needed another solution, so Taylor suggested programming each host computer to both perform computations and also communicate with the network. He did not find a warm reception to this idea. Programming the computers to talk to the network tied up already-limited computing power. Though the group of researchers outlined their requirements for the experimental network, the question still remained: How would they get computers programmed in different languages to talk to one another? Each computer operated with a custom programming language. Without a common language, they faced a difficult problem. At the meeting cybernetics expert Wes Clark passed a note to Taylor that read, "Your network is inside out." (Hafner and Lyon 1998). After the meeting in the car on the way to the airport, Clark, Roberts, Taylor, and a couple other researchers sketched out a system that left the host computers out of network communication entirely. Clark proposed a subnet where a small computer would communication with the network, leaving the host computers' computing power in tact. The subnet would comprise the smaller computers rather than the host computer. Most importantly, programmers would only have to write code to talk to the subnet rather than every computer on the network – the exact idea Davies proposed. The ARPA team eventually became aware of Davies' packet-switching research at another meeting later that year, and through it also found Baran's research. Later, during the design of ARPANET, Davies visited Roberts, finding that his paper "had been used so much that its pages were falling apart" (Hafner and Lyon 1998, 77).

These meetings are indicative of the collaborative, information environment of ARPA in the 1960s. As Kennedy's New Frontier stepped up funding for command and

control measures with computers played a central role. For this reason, Edwards claims in *Closed World* that ARPA precisely demonstrates how military research problems could shape a scientist's intellectual interests. Licklider and his colleagues were working on a problem contextualized by "command and control in electronically mediated, partially automated, eventually computerized systems" (Edwards 1997, 268). Even as the Kennedy rhetoric implied values of self-reliance and rugged individualism would lead to American expansion into the unknown, ARPANET was created informally and fashioned to embody the values of the scientists. Janet Abbate in *Inventing the Internet* points out that IPTO managers encouraged contractors to work together as peers, and colleagues to share skills and insights as equals. "Having been researchers themselves, they subscribed to the view that the best way to get results in basic research was to find talented people and give them room to work as they saw fit" (Abbate 2000, 55). Even as Taylor solicited opinions about the experimental network from researchers in Ann Arbor, the men around the table debated rationally as peers. Just as the Manhattan Project scientists would spend their Sundays climbing Lake Peak and talked about physics problems in the sunlight, the ARPA researchers shared ideas and sketched out plans for the network traveling to meetings, late into the night at bars, and, in the case of Licklider and his best friend UCLA researcher Leonard Kleinrock, while playing roulette and blackjack in casinos. "Layering and a decentralized, collegial approach to management came to be seen by members and observers of the project as essential characteristics of the ARPANET, and were later held up as models for successful project development" (Abbate 2000, 51). In effect, ARPA reincarnated the wartime OSDR, and the IPTO operated as an independent

organization led by a small directorate of researchers with minimal oversight from the military.

By 1968, Taylor funded the first node of the experimental network at four sites – UCLA, Stanford Research Institute, University of Utah, and University of California-Santa Barbara. Each site was selected for a unique characteristic. UCLA and UCSB already had internal networks. Utah researchers provided interactive graphics. ARPA principals selected SRI because Douglas Engelbart worked there. ARPA would install an Interface Message Processor at each of the four locations and lease 56-kbs telephone lines to connect them, forming the core of the experimental network. Roberts was the network's principal architect, establishing the guiding principles. Chief among these requirements was reliability, which meant the IMPs needed to operate independent of the host computers. If host computers or even individual IMPs were down for service, the subnetwork needed to continue functioning. As Robert wrote the thick requests for proposal, he assembled a small team to galvanize the technical requirements for the network footbridges, recruiting RAND's Paul Baran to advise the group. The IMP hardware and software proposal was novel. Unlike other projects, which operated on personal connections and the director's knowledge of contractor expertise, Roberts sent request for proposals to 140 companies.

The unique capabilities of the IMPs might have encouraged Roberts to cast a wide net for proposals, but he eventually ended up granting the contracts to a company with close personal connections. Roberts contracted Bolt, Beranek, and Newman (BBN) to build the IMPs. The company was small, but had significant, important personal ties to the IPTO already. Licklider worked at BBN before leading the IPTO. Roberts also knew

BBN researcher Robert Kahn from early meetings about the ARPANET. Other contracts were even less formal. Roberts hired UCLA scientist Leonard Kleinrock, a fellow MIT graduate to analyze the network systems. Kleinrock already received ARPA to support several graduate students, including Stephen Crocker, Vinton Cerf, and Jon Postel – three eventual Internet pioneers in their own rights. Based on Roberts' relationship with Engelbart, Stanford Research Institute received a contract to create the collaborative Network Information Center (NIC), which would serve as the online resource for network personnel and documents. Finally, Roberts also established the Network Working Group (NWG), an informal community of software researchers who were developing protocol specifications for the host computers. In sum, contracts were largely awarded due to personal social connection to ARPA directors. In September of 1969, BBN installed the first IMP at UCLA. Within three months, the four-node network went online connecting UCLA, SRI, UC Santa Barbara, and Utah. By the end of 1971, ARPANET had 15 nodes. In the decade between 1973 and 1983, ARPANET underwent a number of upgrades, including sequestering military nodes into their own network, switching its packet-switching protocol to TCP/IP, and forming a larger network of civilian and military networks called the Internet.

Like the atomic bomb, the Internet was born from the marriage of military and science. ARPANET was built at the height of the Vietnam War and funded by the Cold War for military customers in a science community built during World War II, yet IPTO managers emphasized research rather than military objectives. Congress and the Pentagon expected to see deliverable from their liberal funding despite that fact that ARPA at its heart was an agency founded to perform basic, rather than applied, research.

The network was constructed in an environment with ideological pressures exerting pressures both from the top-down and bottom-up. Engineers built into the networking technology values advantageous to the military such as survivability, flexibility, and high performance over commercial goals such as low cost, simplicity, or consumer appeal (Abbate 2000). At the heart of the Internet was control, but researchers as a culture were distinctly open and collaborative – a value they built into the network. ARPA managers were integral to allowing researchers to build the network sewn with these values, shielding them from political pressures in Congress and the Pentagon. The directorate of researchers at the head of ARPA was careful to frame the agency's research in terms of military application despite rarely asking for defense rationale. "Many of the IPTO's computer science projects were proposed by the researchers themselves, or were designed to allow researchers to continue work in areas they had explored independently" (Abbate 2000, 77). Often the military application came after the fact even when individual elements were military hardware. In the 1960s, Baran's distributed network was a solution for the telecommunication network to survive a nuclear attack. The IPTO was founded to develop command and control software for a nuclear defense shield against a Soviet nuclear attack. Later, IPTO and ARPA directors pitched ARPANET as an efficient cost-savings tool at various times during its development. Wes Clark viewed IPTO contracts as always having a loosely defined military objective, but they served as suggestive rather than necessary. Compared to sister organizations like the National Science Foundation, ARPA had nearly no oversight from Congress. In 1965, the Department of Defense funded 23 percent of university science in the United States; the National Science Foundation funded nearly 13 percent (Abbate 2000). The NSF, however,

underwent great scrutiny from Congress. Taylor posited that Congress saw ARPA's research as part of a whole rather than an "*in toto* a research organization" (Abbate 2000, 75).

Though Vannevar Bush promoted the NSF as the center of federal research, the organization was heavily politicized as the National Science Foundation Act of 1945 made its way through Congress. Truman initially vetoed the bill because he felt an organization without oversight was unconstitutional. He wanted scientists to serve as a specialist role rather than administrative. As Zachary Pascal put it, "he wanted experts on tap, but not on top" (Zachary 1997, 333). Bush saw politicians controlling scientific research as the second worst possible scenario. The *worst* possible scenario was research falling solely into the hands of the military. Bush spent most of his postwar career grappling research functions away from military officers that he subsumed with the OSDR. In his role as chairman of the postwar Research and Development Board, Bush spent two years in a turf battle with the Army, Navy, and Air Force. Each service had overlapping research projects that Bush attempted to bring under the roof of the RDB. "Bush tried in vain to enforce his will on the recalcitrant Joint Chiefs. [Secretary of Defense James] Forrestal backed Bush's bid to unify the military's research program but organizational defects and parochial attitudes checked his progress" (Zachary 1997, 337). Just ten years later, ARPA was founded; the organization structured after Bush's successful Office of Science and Research Development. ARPA was deeply embedded in the Department of Defense with its central office in the Pentagon and the program directors equivalent to the rank of brigadier generals. There's a certain irony that Bush's Endless Frontier was eventually realized in the C-ring of the Pentagon.

In the first chapter, I looked at the consolidation of Western land for large-scale wartime science projects and Teddy Roosevelt's defense of public land with frontier rhetoric. During World War II, science was performed in the West – and the land rush continued into the Cold War. Federal spending in the West after World War II created a second land rush while stimulating and even creating local economies. In the cold war years, the Department of Defense, NASA, and the Atomic Energy Commission spent 15 percent of the national budget. Between 1961 and 1965, NASA contracts to Western states totaled $5.3 billion – or nearly half of NASA expenditures. Science and defense became inexorably linked. "More than 90 percent of federal research and development contracts and half of its science grants were awarded by defense agencies" (G. D. Nash 1999, 96). Among the Western states, California boasted more research and development contracts than any other state. After WWII, dozens of research and development installations for weapons projects sprouted from the federal landscape of the West. Los Alamos and Sandia National Laboratory campuses built post-war occupy more than 30,000 acres in New Mexico, with 20,000 staff members and a combined budget of $5 billion. Rocky Flats in Denver manufactured triggers for nuclear weapons from 1952 until 1992, creating and also destroying a local economy.

Gerald Nash's overview of federal defense spending between 1945 and 1965 shows that a quarter of military and civilian employees lived in thirteen western states (G. D. Nash 1999). "Thus, after World War II and its aftermath saw the formation of the scientific-industrial-military complex that remains arguably one of the most powerful economic sectors in the United States" (Kuletz 1998, 42). After World War II, dozens of research and development installations set their roots in the Western states because the

land was either cheap or federally owned. When Manhattan Project manager Leslie Groves and Oppenheimer looked west for their bomb-making locations, they saw empty space. By the Cold War era, the West was an enclave for high-tech companies that produced missiles, computers, and electronics. The West became the place where research and development was performed. In the 1950s, federal dollars filtered into California, Washington, Kansas, Utah, Colorado, and New Mexico through technology contracts. Environmental historian Gerald Nash points out that in the 1960s Austin attracted companies like IBM, Advanced Micro Devices, Intel, and Motorola. California's Silicon Valley is still home to many high-tech corporations – in part due to defense funding in the universities and industry. Kennedy's New Frontier grew out of the fertile post-war scientific community envisioned by Vannevar Bush *in Science: The Endless Frontier*.

CHAPTER V

THE FRONTIER OF CYBERSPACE

In the last three chapters, I've looked at the Internet as a phenomenon developed as successive invocations of the rhetorical frontier. The first frontier, Vannevar Bush's Endless Frontier of science institutionalized the funding structure for science research in the United States, the military-industrial-academic complex. The second frontier, Kennedy's New Frontier once again enlisted scientists and engineers as frontier heroes. To face down the Soviet Union the New Frontier administration sent a deluge of funding into the institutional pipes laid out by the Endless Frontier. The military-industrial complex swelled with the fresh money for space exploration, advanced weapons systems, and command and control infrastructure. Advanced Research Project Agency was uniquely suited to develop functional prototypes of theoretical engineering concepts because it was well funded, underwent little Congressional oversight and attracted top-tier scientists. The third frontier moves away from the infrastructure of the Internet to the content. In the 1990s, the Internet expanded beyond the community of computer scientists to the general public. The Internet became a metonym for the content and all online activity. In this chapter, I'll show how the values associated with the popularized Internet in the 1990s reflected the collaborative environment of the ARPA engineers.

This chapter is premised on the idea that the Internet was portrayed rhetorically both as a wilderness and a frontier in the 1990s and 2000s. When invoking the Frontier Thesis, there's always a wilderness that's conquered by a frontier hero. In the successive wave of development that follows the frontier hero, the frontier opens civilization. Frederick Jackson Turner instilled the wilderness, frontier, and frontier heroes with

values that find their way into almost every subsequent invocation. These images and values frame the Internet as the electronic frontier. I'll first show an example of a physical analog for the Internet as a frontier. One particular community exemplifies Internet values – the Burning Man festival. Second, I'll show the Internet treated in public discourse as both a Romantic and pre-Romantic wilderness according to their respective values I discussed in chapter 2. As the Internet developed, however, some parts preserved the "savage," relentless pre-Romantic notions of the wilderness. Third, I'll demonstrate how the frontier metaphor changed in the 1990s to defend the Internet as finite resource – both as a frontier and the wilderness. By tracing the mission the Electronic Frontier Foundation, foreign government's to limit freedoms, and rise of monolithic Internet companies, I'll show first how the Internet might still be expansive, but certain operational values required defense. Finally, geography is as important in the decade of the Internet's popularization of the Internet as any other point in time.

Each year since 1986 thousands of people have gathered on a remote, dry lake about 100 miles north of Reno for a weeklong celebration of self-expression called Burning Man. In 1996, event founder Larry Harvey's opening speech to the 8,000 attendees called the desert gathering "a compelling physical analog for cyberspace." The comparisons are striking in many ways. Burning Man began as a summer solstice fire party on Baker Beach in San Francisco in the early 1980s. By 1986 the Baker Beach parties drew too many people for Harvey to secure permits, so he moved the event to the Black Rock desert in Nevada. Since then Burners, as the participants are called, congregate in the desert each year, creating a temporary city in the desert – and then they leave a week later without a trace. Burning Man's tenants urge its citizens to live

authentically with complete self-expression and self-reliance. “It is, like cyberspace, a frontier in which individuals can exercise remarkable freedoms. Our desert world and the blank expanse of its playa form a decontextualized arena of action” (Clippinger and Bollier 2014). Harvey and his cadre provided the space, and the Burners built everything else: themed-communities, massive art projects, and “mutant cars” – vehicles modified to look like pirate ships, dragons, or mermaids. While the event has always been self-organized, until 1997, the event was completely unorganized and only partially decontextualized. Harvey was right. He created a frontier where people could experience life without governance or guidelines, but individuals embracing their total freedom brought their own ethos.

The new venue away from civilization in the center of 318,000 acres of desert brought an anarchist element, which the community initially tolerated, but not necessarily condoned. Although Burning Man was not necessarily founded on anarchist principles, Harvey recalls: “We were not in any a subculture, but this new group brought with it an underground ethos” (Clippinger and Bollier 2014). It was an “anything goes” ethos. People sped through the desert in their cars at 100 miles per hour with their lights off. Burners lived up to their moniker. They built structures and then ignited them with flamethrowers. Just days after Harvey compared Burning Man to cyberspace, a motorcycle crash killed one man and a speeding vehicle ran over two tents in the middle of the night, injuring its occupants. Harvey realized it was time to invent a government, a de facto state for the gathering along with a value system. He and the other organizers decided to eliminate firearms and regulate traffic. They even gave everyone an address within a unique street grid – a semi-circle with the eponymous giant Man structure at the

center. As the temporary city took shape, the founders instilled with the architecture of the city itself values that supplanted the tacit underground ethos. Burning Man co-founder Rod Garrett wrote: "Our goal was to express and abet a sense of communal belonging, and establish population densities that would lead to social interactions. Concurrently, we were attempting to recreate some of the intimacy of our original camping circle, but on a much larger civic scale" (Clippinger and Bollier 2014). The semi-circle was a metaphor for the campfire origin myth and also provided utility. For Burners to find their way back to their camp, they only needed to remember the alphabetized ring of their site within one of the concentric circle and its location on a clock-like dial (for instance, 10:30, C). Following the disasters of the 1996 Burning Man, founders brought ordered society. Order followed the ordered streets. The 1997 reforms angered anarchists, but they too could participate within the boundaries of the new phase of Burning Man – as long as they followed the new rules.

Harvey galvanized Burning Man's tenets in the "Ten Principles of Burning Man," further instilling the festival with values for participation, individualism, and commerce. The Ten Principles were the Burning Man's Frontier Thesis. Four of the principles compel the individual: radical self-expression, radical self-reliance, immediacy, and participation. Four are guidelines for the community: communal effort, civic engagement, radical inclusion, and Leave No Trace. Finally, two create Burning Man's gift economy: gifting and decommodification. With these principles Harvey dictated the norms, narrative, and universe for their desert utopia. Physically, Burning Man rises out of the desert from nothing each year. "Within a desert wilderness we build a city, a model world composed of people who attend our event from all over the globe" (Clippinger and

Bollier 2014). Burners build everything besides the architecture for the city. He changed the universe from an anarchist encampment to the *playa* – a term meaning "beach" in Spanish that Burners use for the desert location. Geography is important. The narrative outlines a utopia where gift giving supplants bartering and commerce, and self-reliance paradoxically rises to the supreme tenant within the communal gathering. Just as Frederick Jackson Turner developed a set of desirable values that lead American settlers into the frontier experience, Larry Harvey first facilitated a city in the desert and then built into it value-laden principles for its denizens. His metaphor brings to light key comparisons between the development of the Internet and the Web.

When Harvey compared the gathering to the structure, rate of growth, and community. In comparing cyberspace he pointed to the multi-ethnic community the event draws and self-reliant themed villages built from nothing. Furthering the analogy, I'll also point out that the Black Desert is federal land managed by the Bureau of Land Management. The central authority only dictates principles for how to live rather enforcing them. As Peter Hirshberg points out, Burning Man's "core directions are set by a small team of founders who curate and exercise their judgment more as Plato's philosopher-king than as leaders of a democratic state" (Clippinger and Bollier 2014, 951). The tenant of radial participation means the community also radically self-polices the values. If the concentric circles of road system are the Internet, then the themed villages are the Web – the content layer of the infrastructure. The "Ten Principles" are the instructions for acceptable behavior. Individuals conform to certain self-policed regulations while participating both on the Web and at the festival. Though the principles

challenge any control, they primarily mean outside control from corporations, government, or society.

One of the often unspoken tenants of the Frontier Thesis is the temporary state of the space between wilderness and civilization. The frontier eventually became civilization. The archetypal pioneers invoked deep cultural myths about the American national character, but they're only useful in the initial stages of colonization. As the trope goes, the restless pioneer moves on as he sees the smoke of other fires behind him – or when there is no place else to go. Normalization follows the frontier, which means establishing law and order, building fences, and rounding up outlaws. Though it appears that Burners found an institutional crack where they could thrive as autonomous individuals, Harvey's tenants served to standardize the individual within the community. Burning Man, indeed, was a physical analog for the frontier, particularly because it was addressed in the final year for the gathering's frontier phase.

Just as conceptions of the American West range from the idyllic frontier where settlers could escape the dense urban areas to the location of holocaust for Native American, cyberspace shines as fertile territory for commerce and also a haven for child pornographers, gambling, and hate groups. The rhetorical wilderness is elastic. One person's wilderness is another's frontier. Some groups defend privacy and anonymity as a necessary part of the frontier condition. Some individuals are simply afraid of the Internet. A 2000 Pew Internet and American Life study found that among non-users more than half think the Internet is dangerous (Lenhart 2000). Other groups view privacy and anonymity as the conditions that make the Internet a tool for tyrants and den for

miscreants. If the "surface web" is the civilized Internet, then the Deep Web has been described as the outlaw counterpart, the wilderness in the pre-Romantic sense.

Describing the entirety of Web content inaccessible to search engines, the Deep Web remains a misnomer. More accurately, the network of web "hidden services" hosted on the Deep Web, which are accessible only with an anonymizing "onion router" – of which the best known is the Tor Browser Bundle (TBB). The Deep Web drew significant media attention in October 2013 when federal investigators closed the online marketplace Silk Road, known as a major black market for drugs and other illicit items. Wholly transacted in the anonymous cryptocurrency Bitcoin, Silk Road reportedly generated $1.2 billion in sales during its two years of operation, making it the most successful black market on the anonymous webspace, but not the only one. The Silk Road was made possible because of its anonymity. Services like the Silk Road are called hidden services. Hosted hidden services include web content similar to "surface web" content such as marketplaces, forums, websites, and blogs, except they're only accessible from an onion routing browser. Onion routing browsers relay web traffic through a series of separately encrypted proxies (called onion routers) "that reroute messages in an unpredictable path" (Bergman 2001, 276). The TBB bounces users' web traffic to a network of relays around the world, preventing sites from learning their physical locations, blocking cookies and other data-mining software, and allowing dedicated access to regular websites and also a special network of encrypted forums, marketplaces, and webpages. Recent criminal investigations into blackmarkets and child pornography rings that operate on Tor hidden services has driven public discourse and political rhetoric toward labeling the network as a den for perverts and criminals, but many other type of users who want to entirely

conceal their identity also use onion routing, including dissidents, whistleblowers, and journalists.

Interestingly, Tor originated as an ARPA-funded Navy project in 1998 (ARPA was changed to the Defense Advanced Research Project Agency in 1990). According to DARPA's Information Innovation Office, NRL and SRI International continue to develop the Tor network with funding from the agency's Safer Warfighting Communications (SAFER) program. The stated goal of SAFER is to "develop technology to enable safer, resilient communications over the Internet, particularly in situations in which third parties attempt to discover the identity or location of the end users" (Walker 2014). Among the organization Tor website thanks for continued financial and non-financial support are National Science Foundation, Electronic Frontier Foundation, Google ("Tor Project: Overview," n.d.). Despite the illegal uses associated with Tor hidden services, the U.S. government funded the network to usurp Internet censorship in totalitarian countries. In the Cold War, the CIA smuggled photocopiers into the USSR for dissidents to use to create and distribute pamphlets to fellow revolutionaries. The Navy developed the Tor network to secure government communications. The Tor Project promotes Tor as a means for dissidents and journalists circumnavigate government controls.

Evgeny Morozov illustrates the dark side of Internet freedom in *The Net Delusion* (2011). The Belarusian scholar and writer points to the uses of technology by governments and corporations to stifle social change and personal freedoms. Morozov dedicates an entire chapter comparing the vernacular and tactics of the modern day political wars to Cold War rhetoric, drawing heavily from Hilary Clinton's speech about

Internet freedom from the steps of the Newseum in Washington, D.C., on the anniversary of the fall of the Soviet Union in 2010: "The Berlin Wall symbolized a world divided and it defined an era … the new iconic infrastructure of our age is the Internet. Instead of division, it stands for connection. But even as networks spread around the globe, virtual walls are cropping up in place of visual walls" (Clinton 2010). For American policymakers, successfully promoting Internet freedom carries with the same pitfalls of freedom of speech. The same freedom of speech that protects the pro-government activist provides the same protections to the separatist. Promoting Internet freedom is not synonymous with furthering democracy.

Morozov claims that foreign politicians see the control panel as an American machine to spread American political agenda, but found out how to rewire it for their own purposes – with shocking "sophistication in the online world" (29). In 2008, the Iranian Revolutionary Guard launched 10,000 blogs to counteract the secular blogs in advance of the election, artificially inflating pro-Ahmadinejad sentiment online and drowning out the opposition (135). After the Green Movement, the Iranian government collected the hundreds of photos of protests and the protestors posted onto Facebook and Twitter, and used them to find the dissenters. They posted the user-generated images online and broadcasted them on public television asking for the identities of faces circled on the photos. They realized the power of social media and often checked Iranian citizens' Facebook accounts at border crossing for connections with revolutionaries. With the interconnectedness online, Russia's KGB traced individuals' online connections and built social maps to triangulate potential dissenters' groups. In both these instances, tech-savvy governments turned the user-generated, public information back onto the

revolutionaries. Morovoz laundry listed dozens of such offenses. In their efforts to maintain the status quo, the governments surveil their populations and engineer media environments.

The pre-Romantic wilderness also extends to other "dark qualities" about the nature of the Internet including the effects of anonymity and deindividuation. Early studies into anonymity and deindividuation theory arose from the quality and morality of citizen-generated letters to the editor in daily newspapers. Saks and Ostrom (1973) found that unsigned letters were more likely to include themes from which they feared reprisal. Other pre-Internet studies showed that anonymity increased aggressive behavior (Zimbardo 1969) and encouraged suicidal individuals to follow through with their attempts (Mann 1981), which are issues as prevalent in the contemporary online realm. Spears and Lea (1994) put deindividuation theory to work within a mediated environment with their social identity model of deindividuation effects (SIDE). When applied to anonymous, online environments SIDE shouldn't necessarily be classified as mob mentality; however, individuals experience the same loss of self-identity and no longer fear retribution for breaking social norms. Internet-era cases of deindividuation include cyberbullying and encouraging suicides. In 2008, 19-year-old Abraham Biggs posted a suicide note to a message board along with the recipe for the "drug cocktail he intended to consume" (Stelter 2008). Strangers on the forum reportedly encouraged him to take the drugs and then watched online as he died. Closing the *New York Times* article, University of Southern California communications professor Jeffrey Cole said, "The anonymous nature of these communities only emboldens the meanness and callousness of the people on these sites" (Stelter 2008, para. 23). Nash points out that when pioneers got too close

to the "savage" wilderness, they too became savage. If the hidden Tor services are the Wild West, then Facebook and other large walled gardens are the settled territories.

John Gilmore, one of the founders of the Electronic Frontier Foundation, coined the familiar Internet trope: "The Net sees censorship as damage and routes around it." In that same article, *Time* reporter Philip Elmer-Dewitt writes: "There are no TV guides to sort through the 5,000 discussion groups or the 2,500 electronic newsletters or the tens of thousands of computer with files to share" (Elmer-DeWitt and Jackson 1993). He compared new Internet users to mariners floating "adrift in a borderless sea" (1993). Engineering librarian Glee Willis said of the Internet, "it's a family place. It's a place for perverts. It's everything rolled into one." The modern Internet is much different in some ways, but the same in others.

Internet search engines provide the "TV guide" to sort through the estimated 1.97 billion indexed websites (de Kunder 2014). Google is the juggernaut in the search engine arena, proclaiming itself as *the* place to search for information on the Internet, which latest market share data confirm. In January 2014 comScore, the most widely accepted measure of Web search engine competition, released its monthly qSearch analytics data showing Google powering 68.9 percent of the 19.6 billion worldwide Internet searches (Lella 2014). The engine's advanced algorithm blends website characteristics such as keyword relevance, and site and page quality with personal information it collects from users such as their geographic region, web history, and personal content from other Google services ("How Search Works" 2014). As a condition of using their search engine, users grant Google permission to track their searches and sell sponsored links to the highest bidder for specific keyword searches. According to the

company's FY2013 annual investor report, they sold $3.5 billion worth of advertising to appear beside search results (Duncan 2014).

Communities formed on the Web from the earliest days of USENET newsgroups. Rising monolithic in the Internet landscape are "walled gardens," or closed ecosystems where companies control the digital environment in which their users shop, commune, search, or interact. With 1.2 billion active users, Facebook is the largest walled garden. As a condition of using the service, users grant Facebook permission to use their personal information in advertising. Even outside the walls of the proprietary online communities, web browsers store cookies from websites, which record and send data back to the company about the users' previous activities. As Internet users become increasingly aware of the technological means by which companies and government organizations monitor and track web traffic, they are more likely to conceal their online activity through the use of advanced privacy settings and anonymizing software. Whether installing an ad blocker on their browser or employing the use software that masks their Internet Protocol (IP) address, the Pew Internet and American Life Study reports that 86 percent of Internet users attempted to mask their online behavior or avoid being tracked (Rainie et al. 2013). Approximately half the Internet users polled said "they were worried about the amount of personal information about them that is online – a figure that has jumped from 33 percent who expressed such a worry in 2009" (5).

The final line of the *Time* article "First Nation in Cyberspace" states: "While it may be difficult for communities as diverse as those on the internet to set their own agenda, it seems increasingly likely that if they don't, someone else will do it for them" (Elmer-DeWitt and Jackson 1993). In 1996, founding member of the Electronic Frontier

Foundation John Perry Barlow wrote "A Declaration of the Independence of Cyberspace" set an initial agenda for the virtual world. In the opening line of the sixteen-paragraph treatise, Barlow wrote: "Governments of the Industrial World, you weary giants of flesh and steel, I am from Cyberspace, the new home of Mind. On behalf of the future, I ask you of the past to leave us alone. You are not welcome among us. You have no sovereignty where we gather" (1996). Written as a response to the Telecommunications Act of 1996, which deregulated the telecommunications industry, Barlow demarcates cyberspace as a region outside the boundaries of a single nation – or any nation – to control. In 1993, John Farber jested that: "We ought to apply to the U.N. as the first nation in cyberspace" (Elmer-DeWitt and Jackson 1993). But if that happened, Facebook and its 2 billion users would probably be a new global superpower. The EFF still fights against the government, but recently turned toward industry. "While early threats to our right to communicate came from the government, current threats come also from industry, as it seeks to control and expand current revenue sources at the expense of traditional fair use" ("A History of Protecting Freedom Where Law and Technology Collide" 2015).

As these companies grew while monetizing user information, the call for Internet defense grew louder. Rather than defending the Internet as a frontier with limitless resources, organizations like the Electronic Frontier Foundation called for defense of a value system. When Teddy Roosevelt invoked the Frontier Thesis, he replaced the traditional pioneer with the "farmer-hero," redefined the unlimited frontier to a finite environment, and emphasized community rather than individual efforts (Dorsey 1995, 3). Roosevelt's rhetoric from 1901 to 1909 was specifically developed to combat industrial

interests to harvest minerals, lumber, and energy in the Western states. According to Dorsey, when Roosevelt came to office, one-half of the country's timber had been cut, wasteful mining operations poisoned entire ecosystems, and profit-minded hunters nearly wiped out once-abundant species. In his "First Annual Message," conservation of natural resources represented "the most vital internal questions of the United States" (Dorsey 1995, 6). In order for the new myth to redefine the lessons of the foundational myth, the speaker must approach it in a non-threatening way. Just as Roosevelt believed the resources would eventually run out, rhetoric defending the electronic frontier reinforces the values associated with the ARPA researchers while creating a narrative that they needed defense.

He specifically points to the United States, Singapore, China, Russia, and Italy as opponents to Internet freedom, though he's missing a big point. The place he claims to speak from a place outside control; however, he spoke from the frontier, not the wilderness. Ten years prior, Barlow's cyberspace was significantly smaller and accessible only to government scientists and the military. In the fall of 1985, the Internet was still just university researchers and comprised about 200 computers. Four years later, the number had grown to 159,000 (Abbate 2000). Applications like USENET connected users in newsgroups, though the most common applications were email and file sharing. In 1990, ARPA turned the infrastructure of the nascent Internet over to the National Science Foundation's Computer Science Division. In a watershed moment of Internet history, the NSF opened access to the public. No single corporation could control access to the Internet, but the 1990s were a veritable land rush for the new dotcom companies. Within a few short years, America Online (1991), Amazon (1995), Ebay (1995),

Wikipedia (2001), and Facebook (2004) pioneered a new industry on the endless frontier of cyberspace, bringing with them new challenges for the network society. The Internet might not be limitless, but the values associated with the electronic frontier are seen as endangered. Unlimited space implies conquest, but finite, cherished land requires defense. Thus, the Internet frontier narrative changed from lauding the actions of the industrious technologists to the collective effort to cherish and protect something finite – Internet freedom.

The Internet of the 1990s was also geographic for a number of reasons. First, the liberty afforded to individuals was dependent on access to the Internet. Second, the limitless frontier of cyberspace actually has an upward limit on its size in a few dimensions. In the second decade of the popularized Internet, the world nearly ran out of IP addresses. I'll also show that U.S. institutions controlled and maintained the Internet for the first 20 years of its existence with some implications.

The Digital Divide is the disparity between the people who have and do not have access to the Internet in the United States. The values associated with the Internet might make it a place for unlimited prosperity and opportunity, but you have to have a computer, Internet connection, and know how to use them. In the 1980s, without a usable graphic user interface (GUI), scientists and researchers relied on programming languages to control their digital computers. Even Vannevar Bush, an early inventor of analog computers, found that software and programming language was beyond his abilities. Environmental historian Roderick Nash points out that the idea behind the "safety valve" theory might have been successive to Jeffersonian agrarianism, but it didn't work. The land might have been free, but the start-up costs were beyond the average low-income

American. Immigrants had a better chance to settle the Western states because they weren't tethered to a particular city. The reality is that like the actual frontier, a certain amount of capital and know-how was required to homestead the new space. The invention of the user-friendly operating system, personal computer, and World Wide Web brought the collaborative Web environment closer to rural and urban Americans, but not close enough.

In 2000, the Pew Internet Research Center published a report called "Who's not online" from 1998 surveys (Lenhart). The report notes significantly less Internet penetration in rural areas, noting that 57 percent of respondents in rural areas did not have access to the Internet. Geography plays a role in Internet access, but the digital divide also describes individuals in socioeconomic status who do not have Internet access. The Pew study found the same to be true, finding that just 31 percent of individuals who live in households earning less than $30,000 annually have access. The first obvious step is to get a computer into the home and then show value for Internet access.

The Digital Divide extends beyond the geographic and socioeconomic conditions in the United States – it's also a global issue that's drawn attention from the United Nations and other international rights organizations. Organizations like U.S.-based Internet Corporation for Assigning Names and Numbers (ICANN) don't regulate Web content, but they maintain considerable influence over the infrastructure of the Internet. Created in 1998, ICANN is a private, non-profit corporation contracted by the U.S. Department of Commerce to manage the Internet's Domain Name System (DNS) and assign domain names. More importantly, it also runs the Internet Assigned Numbers Authority (IANA), which allocates IP addresses to Regional Internet Registries (RIR),

which in turn assigns them to the Internet Service Providers (ISPs) in their respective countries.

ICANN provided reliable maintenance of Internet infrastructure to a global community for more than 20 years, particularly the development and allocation of IP addresses for net-connected devices. Stanford computer scientists Vint Cerf and Bob Kahn developed the experimental IPv4 for a small ARPANET system in the 1970s. For this experiment, they used a 32-bit address, which provided a seemingly adequate supply of 4.3 billion addresses. However, a growing Internet quickly exhausted the available space in the protocol.

In the 2000s, IANI managed the growing address depletion crisis, gradually shifting to allocation policies "that require ever-stronger justification for additional space" (Klensin 2002). As the protocol filled up, developed countries received the majority of the free space. In the system of priority, each country must justify its allocation. A glance at the IP address allocation by country, African countries comprise the 20 nations the lowest IP addresses per 1,000 citizens (*Allocation of IP Addresses by Country* 2014). The United States, Sweden, and Norway have the highest IP addresses per 1,000 citizens. The United States, China, and Japan are allocated the highest number of total IP addresses, followed by the United Kingdom, Germany, and South Korea. This cursory glance shows a geographic and socioeconomic disparity in allocated IP addresses. IPv6 changes that dynamic, but IP modernization comes slowly for the developed countries – and slower for the underdeveloped.

In 2012, ICANN launched a long-awaited expansion of Internet protocol from 32-bit addresses to 128-bit addresses, which, according to Cerf, will provide about as many

IP addresses as "there are electrons in the universe" (*Dr. Vint Cerf on "Reinventing the Internet"* 2013). IPv6 will solve many of the issues pointed out by Pickard about IPv4, particularly the appropriate allocation of IP addresses to developing and third-world countries. The allocation of IP addresses only remains a problem as long as the system runs on IPv4. As of 2013, 96 percent of the Internet still runs on IPv4 because Internet Service Providers refuse to transition (*Dr. Vint Cerf on "Reinventing the Internet"* 2013). As a global, soon-to-be multi-stakeholder governing body, ICANN doesn't have the same North-South implications as the transnational corporations that control the hardware and software. Unfortunately, the transition relies upon the major ISPs to implement their protocol, and even then IPv6 won't reverse the long-standing social and cultural issues of globalization or modernization in a network society.

As we saw in chapter two, the wilderness is as important to the frontier condition as civilization. Romantics idealized a space between the sublime wilderness and oppressive civilization. Industrial interests viewed wilderness as the useless, "savage" land extending west of the edge of American civilization. In the metaphor of the Internet, the ARPA researchers created the wilderness when a space solely reserved for collaborative scientific research opened to public, allowing limitless economic prosperity for anyone who settled it. The Internet of the 1990s and 2000s was partly a frontier and also a wilderness – it just depends on the location of the universe, hero, and narrative.

CHAPTER VI

CONCLUSION

A frontier is ideological rather than physical. A frontier is a myth, metaphor, and descriptor. In some cases, frontier imagery is a benign descriptor attached to a pastoral aesthetic. When deployed in political rhetoric, the semantic value of the word "frontier" remains remarkably consistent with the active national narrative of U.S. expansion. With each new discovery or new place, the people identified as "pioneers" in their respective areas of study or conquest, scratch out a new frontier from the wilderness. In their constitutive rhetoric, the mythmaker draws from cultural images that embody a specific set of values commonly associated with the myth of the American west – and the origin of the American character. There are those who claim the Internet is still a place of limitless possibility and democracy. There are also those who claim the Internet should be regulated. There are others who say both should happen. Both sides often rhetorically treat the Internet as a frontier, whether in spirit or metaphorically by invoking imagery from the myth of the American frontier. In doing so, new mythmakers introduce the same ideological problems of the American frontier into a digital space.

Like other frontiers, the Internet emerged as a free, open space and its metaphorical closure comes with censorship and exclusion of privileges by regulation, but treating the frontier as a discreet place rather than an ideological process is problematic. Pioneers and policy create frontiers from wilderness. Rhetoric from protesters and the regulators equally engage the frontier metaphor either explicitly or while defending the values commonly associated with the Internet as the electronic frontier. In this concluding this thesis, I'll discuss the problematic defenses of the Open

Internet in its infrastructure and content. First, I'll demonstrate the continuation of American expansionism in the Internet infrastructure governance. Second, I will examine recent protests against content regulation.

In the past three chapters, I've shown politicians use the myth of the American frontier to promote expansion, protection, and competition. Each new mythmaker slightly changed the narrative, universe, and hero of the foundational myth in metaphor. In 1906, Teddy Roosevelt invoked frontier imagery to protect the remaining undeveloped lands of the Western states by rhetorically creating a cherished space. The resulting legislation resulted in the authorization of $80 million for the reclamation of three million acres of land, which eventually led to the establishment of the U.S. Forest Service and later the National Park Service. In 1945, Vannevar Bush expanded the frontier to the infinite to encourage further exploration (and conquest) of the scientific frontier. His recommendations marked the birth of the National Science Foundation, National Laboratory system, and military-industrial-complex. In 1960, John F. Kennedy announced a national commitment to breakthrough into the "new frontier" of space – $33.4 billion from 1959 to 1969 including $26 billion for research and development. From these three examples, we see the wilderness once as a cherished thing and twice as a place to conquer. In the first invocation, the wilderness was cherished because an unlimited resource became depleted and faced destruction. In the second and third invocations, the wilderness was unlimited and required conquest, but not defense. In the rhetoric of the Open Internet, the electronic frontier is unlimited and required defense. Thus, the defense of the Open Internet is defense of its operational feature – the promise of freedom in an open space.

Internet border disputes often arise at the crossroads of Internet freedom, economic realities, and government regulation. The National Science Foundation opened the Internet to commercial and public use in 1986, attaching legislation to ensure no single company could monopolize access. Internet service providers emerged in the late 1980s. In 1991, Tim Berners-Lee created the first-ever website hosted on a server at CERN. Berners-Lee envisioned the web as a "neutral, creative and collaborative space," reflecting the values of the Internet and the scientific community (Savov 2015). The rise of affordable, user-friendly personal computers and the invention of the Web spurred an online land-rush in the 1990s. From this innovation, two finite resources of the web needed regulation – domain names and IP addresses. In 1998, the Department of Commerce contracted the newly formed non-profit Internet Corporation for Assigning Names and Numbers (ICANN) to oversee and coordinate Internet infrastructure, allocate IP addresses, and administer domain names. Prior to ICANN's incorporation, ARPA-funded computer scientist Joe Postel administered top-level domains and IP addresses as a side task to his research. The Internet might not have a CEO or a board of directors, but ICANN and other technical regulatory bodies that determine standards and infrastructural designs do – and they're all based in the United States.

The frontier is a metaphor for American exceptionalism. Frederick Jackson Turner's frontier distinguished the United States from its Europe roots. In later invocations, frontier rhetoric distinguishes the United States from the rest of the world. Though the Internet might seem to have no physical boundaries, root servers and IP addresses operate toward globalization. Manuel Castell (1996) claims that globalization finds its genesis in the rise of advanced telecommunication technologies. In the network

society, Castells points out that global communication networks flow among one other rather than a vertical-hierarchical infrastructure that dominated the modernized industrial world, which has an effect both on social structure and culture. “Technology is a fundamental dimension of social structure and social change” (Castells 1996, 18). While the network society might provide a certain amount of democracy, it also allows a division of labor between American corporations and developing countries – the center to the periphery in cognitive functions. It’s easy then to understand Schiller’s point of view when he writes: “the globalized system might not directly mean imperialism” (1991, 11) though it is propped up by transnational corporations. The information society is merely a technologically advanced industrial society that assimilated to the Western culture of modernization. Though organizations like International Telecommunications Union (ITU) or the ICANN don’t often regulate content, their considerable influence over the infrastructure of the Internet means the democratic future of the platform remains quietly in their hands – at least for now.

In March 2014, the U.S. Department of Commerce made an announcement long-awaited by the international community: that it will relinquish control of ICANN “to support and enhance the multistakeholder model of policymaking and governance” (*National Telecommunications & Information Administration* 2014). Created in 1998, ICANN is a private, non-profit corporation contracted by the U.S. Department of Commerce to manage the Internet’s Domain Name System (DNS) and assign domain names. More importantly, it also runs the Internet Assigned Numbers Authority (IANA), which allocates IP addresses to Regional Internet Registries (RIR), which in turn assigns them to the Internet Service Providers (ISPs) in their respective countries. When the

government agency's contract runs out in September 2015, ICANN will transition to a multi-stakeholder model. Under this model, ICANN will remain in technical control of the DNS and IP allocation, but its oversight will come from a global multi-stakeholder community rather than U.S. governmental agencies. Though attempts to globally democratize ICANN in the past have seen mixed results, it's possible that the end of unilateral control by the United States has ended.

Unraveling the rhetoric of the Open Internet provides insight into an unlimited space that faces depletion of the operational features instilled by its founding engineers – openness, neutrality, and freedom to collaborate. When functioning according to its ARPA-instilled values, the limitless frontier is seen as naturally democratic and open. When these values are threatened, the Open Internet comes cherished. In the early years of the Internet, the electronic frontier exhibited all the features of a Western boomtown – a place where anyone could find their fortune. As corporations and governments attempt to exert control, both netizens and Internet-based companies voice their concerns through online protests and hacktivism. Few things in Internet politics stir greater ire than regulating content.

The first instance of mass protest happened in response to anti-piracy legislation. In January 2012, Internet technology companies and the Electronic Frontier Foundation staged a massive protest against H.R. 3261, Stop Online Privacy Act (SOPA), and S. 968, PROTECT IP Act (PIPA). If enacted into law, SOPA would hold search engines and websites legally responsible for linking to other websites that display copyright-infringing content. PIPA primarily targeted international websites hosting content. The bills defined various techniques for copyright holders to disable blacklisted sites,

including blocking the DNS, and forcing third-party payment processors to discontinue service. While many protestors feared that lawful sites might be censored, the tech companies understood they would be required to police for copyright infringement and held legally responsible for infractions. During the daylong protest, Google blacked out its logo while collecting 7 million signatures on their online petition to "End piracy, not liberty" ("End Piracy, Not Liberty" 2014). Wikipedia diverted 162 million users to a splash page explaining the legal implications of the legislation. In all, more than 14,000 websites participated in the protest. In response, Congress shelved the bills. While the organized protest was successful, other groups attempt to enact change to Internet regulation through hacktivism and whistleblowing. In instances like the 2012 Internet Blackout regulators develop the Internet universe as a place that shelters bad people – content pirates, child pornographers, terrorist organizations. Reverting to the pre-Romantic notion of the Internet-as-wilderness, they find a frightening place that requires control.

This thesis contextualizes the development of the Internet in both a rhetorical and regionalist perspective. In the histories of the Manhattan Project, Information Processing Technology Office (IPTO), and Electronic Frontier Foundation, the frontier metaphor is largely absent. It's clear that the engineers don't think of themselves as heroes. Rhetoric and culture, however, idolized these individuals as archetypal heroes. They were exactly the men and women Vannevar Bush and Kennedy enlisted to take the wilderness and expand the American frontier.

The Internet itself did not explode into existence in a single Big Bang. It also did not manifest solely as the Web. The origins of the Internet and the idea of the Internet

manifest in the linkages of frontier rhetoric in the 1940s, 1960s, and the 1990s as persuasive metaphors. More important than its existence and current use is its early history, particularly when the conceptions of its use were formed. Control, not democracy, is inherent within the structure of the Internet. Early engineers and researchers made it democratic, reflecting their collaborative working conditions. It developed in a social environment of researchers and technicians over the course of decades in a variety of fields. Similarly, strong political speeches brought scientific research funds within grasp for new fields, like computer science and information sciences, while military requirements justified the funds. The politicians contribute the process-oriented history – the origin myth. The engineers occupy the place of discovery, grappling the meaning away from the organizations that funded their research and instilling the system with their own social values – collaboration and freedom of thought. The history of the Internet is as much a history of technology and policy as the struggle for meaning making.

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