

The Amazon Infrastructure

The Kindle occupies an awkward position in histories of mobile computing. It was not the first electronic paper device, and it was overshadowed by the launch of the iPhone seven months earlier in March 2007. The Kindle instead depended on Amazon's infrastructure to attract users. The company rapidly changed from a web retailer to essential infrastructure for a variety of first- and third-party services in its first decade. The company prioritized technologies and infrastructure to transform industries rather than replicate preexisting models. Take web retail as an illustration: in the mid-1990s, mail order was an established business model, but emerging web technologies offered vast improvements over the web's slower and less dynamic predecessor. Amazon took this approach to all new projects. Werner Vogels, Amazon's chief technology officer, argued that "Amazon is a technology company. We just happen to do retail. Everything Amazon does is driven by deep technology stacks."¹

Danny Fortson and Simon Duke, journalists for *The Times* of London, describe Amazon's infrastructure as "the fourth utility—after water, gas and electricity."² The wires and protocols of the internet are far more important as a utility than Amazon (notwithstanding the company's entry into laying undersea cables in 2018), but the hyperbolic comparison gives us a reasonable starting point for thinking about infrastructure.³ Utilities, roads, fiber optics, and Wi-Fi networks are all examples of infrastructure. Etymologically, the prefix "infra-" comes from the Latin preposition for "beneath." Susan Leigh Star and Martha Lampland extend this definition by noting that "infrastructure is something that other things 'run

on,' things that are substrate to events and movements."⁴ Electricity powers other tools rather than being an intrinsically valuable commodity. Others build on the infrastructure developed by utilities and internet services. Often the infrastructure is hidden in favor of the final service. For example, we are less concerned with how an email is transferred from California to Hong Kong than with its authorship and receipt, but a vast technical infrastructure of servers and protocols ensures the message's cross-continental delivery within minutes.

Large technology companies develop modular infrastructure to enable cross compatibility for engineers to rapidly build new internal projects.⁵ Amazon recognized the value of these services to a wider audience and elected to allow third parties to access the infrastructure. The company diversified its business interests to ensure the maximum number of third parties used its services. The footer for Amazon's home page lists forty different enterprises ranging from Withoutabox, a service for independent filmmakers to submit work to film festivals, to Amazon Restaurants, a home-delivery service built on Amazon's delivery network. The company has further business interests in cloud computing and storage (Amazon Web Services, Drive), publishing (DPReview, Kindle Direct Publishing), film (Box Office Mojo, IMDb), fashion (Fabric, 6pm, Zappos), web analytics (Alexa), and video games (Twitch, Lumberyard, Games Studio). These diverse services are connected by providing infrastructure for others. Amazon's annual reports often highlight these successes. For example, in the 2015 letter to shareholders, Bezos states: "Used well, our scale enables us to build services for customers that we could otherwise never even contemplate."⁶ Infrastructure forms "a gateway, permitting other systems to interact with [Amazon] to form a seamlessly interactive network."⁷ Any technology company forming an integral part of the network will remain important as infrastructure even if its primary products or services diminish.

Amazon's infrastructure formed the basis of the company's plan for the Kindle's broad adoption. Sony and Cybook launched ebook readers with similar specifications to the Kindle in late 2007, but the competitors lacked Amazon's sophisticated infrastructure. Sony offers a useful illustration of the benefits of mature infrastructure, since the company failed to create a sustainable ebook business despite its resources and experience building hardware compared to Amazon, which had never released a device before the Kindle. We can think about media formats as a form of infrastructure. The physical medium of a CD or tape cassette plays a subordinate structural role to the content stored on it. Sony has a patchy history of introducing new formats, with Betamax and MiniDisc as just

two of its high-profile failures. The company's investment in proprietary media formats highlights its main limitation in developing infrastructure: it focuses less on cross compatibility, leading to higher development costs.

Amazon instead followed Apple's road map for iTunes and the first-generation iPod by integrating its core services—web-based retail, a large cache of user-generated data, Amazon Web Services, Mechanical Turk—into the Kindle platform. Early commentary asked if this was the ebook's "iPod moment," although the *Wall Street Journal* counteracted this early hype by suggesting that the Kindle was having an "eight-track moment" as a temporary phenomenon.⁸ This initial pessimism stemmed from previous ebook failures and framed Amazon primarily as a retail company in the mid-2000s. The popular press's reporting on Amazon drives its public perception. Profiles of the company viewed its history through the perspective of retail, indicated by titles such as *One Click* and *The Everything Store*.⁹ For example, Brad Stone frames Amazon Web Services in terms of "the everything store" that "stocked Amazon's shelves with incongruous products like spot instances and storage terabytes."¹⁰ Even in 2020, when global COVID-19 lockdowns boosted Amazon's share prices from \$1,900 in January to almost \$3,500 in September, the focus remained on the growth in terms of home delivery, ignoring how Amazon Web Services also saw a dramatic increase in traffic owing to the shift to working from home.¹¹

Table 2.1 shows thematic words that appear frequently alongside "Amazon" in news reports indexed by Google News between 2010 and 2018. Journalistic accounts focus on the company's technology but emphasize its retail operations over developments in media and other markets. This is not atypical, however, as General Electric is still associated with hardware and Microsoft with productivity software despite the companies' substantial investment in other business models. Amazon is most

Table 2.1 Common themes in top 100 collocates of Amazon in the Brigham Young University NOW corpus

Theme	Frequency
Technology (e.g., "Google," "Cloud")	39,522
Retail (e.g., "Purchase," "Retailer")	30,185
Media (e.g., "Studios," "Netflix")	11,258
Meta (e.g., "Bezos," "CEO")	11,196
Other (e.g., "Peru," "River")	5,221

See appendix A for full details.

productively categorized as one of the five “technology giants” alongside Alphabet (Google’s parent company), Apple, Facebook, and Microsoft.¹² Disparate interests across the companies can be tied together by a common use of technology.

Any attempt to summarize Amazon’s complex and diverse historical trajectory will be reductive by nature, and others have already written detailed histories of the company.¹³ My interest here focuses specifically on how Amazon the technology company’s development of the Kindle shaped our popular understanding of ebooks. Nonetheless, several broader concerns are worth addressing first. Undercover investigations by newspapers including the *New York Times* revealed exploitative labor practices in Amazon’s warehouses, head offices, and hardware-manufacturing collaborations with Foxconn in the Hunan Province of China, which, along with perceived tax evasion tactics, overshadow the company’s dominance within retail.¹⁴ The drip of negative articles about Amazon turned into a steady flow by the late 2010s, challenging the company’s narrative. Brian Merchant has documented the problematic connections between Amazon and fossil fuel companies.¹⁵ Caroline O’Donovan and Ken Bensinger revealed the extent of deaths connected to Amazon drivers.¹⁶ It is no coincidence that these investigations emerged while Amazon consolidated its position as one of the largest technology infrastructure companies. As with similar platforms, including Cloudflare, a comparison to more traditional infrastructure such as roads allows these companies to plead neutrality when offering support for causes that would otherwise be deemed unsavory. These criticisms still frame Amazon as a retailer, ignoring expansion into other areas even if they are the primary focus of the article, such as a subhead for an article about streaming football matches describing the company as a “US online retailer.”¹⁷ The focus on expansion over profitability encourages this narrative, as it hides Amazon’s interests in diversification and surprises pundits when, for example, the acquisition of Twitch did not fit into preconceptions of Amazon’s strengths.¹⁸ Retail wisdom suggests that scale is essential, but Amazon understood that, in the digital age, advanced technology trumps physical inventory. Amazon was an underdog to established retailers such as Walmart, Toys“R”Us, and Barnes & Noble, which had yet to exploit the technological and logistical affordances of online retail. Amazon’s focus on technology and infrastructure for retail encouraged Toys“R”Us to partner with the company to boost its online presence in 1999.¹⁹

Amazon’s origin story is well known: Bezos was working as an analyst for the Wall Street investment firm D. E. Shaw in May 1994 when he had a “eureka moment” about online commerce.²⁰ The web was changing from a

utopian space of experimentation to a commercial juggernaut.²¹ Bezos had an epiphany after reading that web use was likely to increase by 3,200 percent per year as users quickly adapted to web-based retail. He identified books as a suitable foundation for establishing an online retail business. International Standard Book Numbers (ISBNs) were widely adopted in the book trade and were easy to convert into a catalog. The materiality of print was also amenable to mail operation: books were nonperishable and could withstand manhandling while shipped.²² After a beta launch in 1994, the website opened to the public in 1995 and was an immediate success. In 1996 the *Wall Street Journal* called Amazon an “underground sensation for thousands of book-lovers around the world, who spend hours perusing its vast electronic library, reading other customers’ amusing on-line reviews—and ordering piles of books.”²³ The novelty of Amazon’s range of services helped normalize online retail and laid the foundations for a more extensive infrastructure.

Virtualization and AWS

Amazon Web Services (AWS), launched in 2004, was the catalyst for the company’s transition from an online retailer to a cornerstone of internet infrastructure. The service was intended as a commerce application programming interface (API) for third parties to use the powerful infrastructure Amazon had built to date.²⁴ Instead Amazon built a “cloud computing” platform integral to the internet’s infrastructure and the second part of what Bezos described as Amazon’s “guts” in tandem with Mechanical Turk.²⁵ Its entry into cloud computing was a dramatic turnaround from Bezos’s acknowledgment in 1999 that the company did “not have backup systems or a formal disaster recovery plan. . . . Computer viruses, physical or electronic break-ins and similar disruptions could cause system interruptions, delays, and loss of critical data.”²⁶ Many large-scale web applications use AWS, most notably Netflix, a direct competitor of Prime Video. Brad Stone argues that this marked a turning point in the development of Amazon, as it expanded the scope of Amazon’s products beyond tangible goods to infrastructure and services.²⁷ The company was an early mover with cloud computing in 2006, which allowed it to build capacity at scale. In turn, this profit could be turned into further investment in research to create new services that benefited external customers and, more importantly, Amazon’s businesses.

The mythical origins of AWS recall that the service developed through selling spare server capacity that would otherwise only be used during peak demand. Amazon’s need to survive the onslaught of purchases

between Black Friday and Christmas led to surplus servers for the rest of the year. Rather than lease extra servers at a premium cost for the busiest period of retail, Amazon could purchase capacity for peak times and then rent the surplus for the remaining ten months of the year. Werner Vogels dismissed this narrative, stating that AWS was developed to provide Amazon employees with a suite of prebuilt network tools to avoid having to develop this infrastructure from scratch before undertaking new projects. Once Amazon introduced this service for employees, it was a short step toward selling this infrastructural service during the early hype around cloud computing.²⁸ Since Amazon pivoted earlier than its competitors, the company established itself as a leader when others, including IBM and Microsoft, took longer to scale up.

AWS's physical presence is hidden literally as commercially sensitive information, and metaphorically by the cloud's association with ephemerality and immateriality.²⁹ Amazon's public-facing customer-centric ethos requires the environmental and labor costs to remain hidden to drive the narrative. These centers are the counterpart to Amazon's distribution centers in enabling the Kindle's online infrastructure to prioritize areas according to socioeconomic affordances and limitations. AWS is one of Amazon's most profitable services. In 2019, AWS provided 12 percent of all net revenue, or \$35.03 billion in total, for a profit of \$9.2 billion. Conversely, despite revenue in excess of \$170 billion, North American product and service sales returned a smaller profit margin of \$7.03 billion, with estimates that costs from COVID-19 will further reduce profitability of the company's physical services during 2020.³⁰ Providing critical digital infrastructure is more profitable than retail, leading to further investment in cloud services at the expense of the perceived traditional strengths of Amazon, including bookselling.

AWS was instrumental to the Kindle's development and success because of its focus on virtualization and abstraction of the computational process. An IBM white paper identifies the virtual computer as "a logical representation of a computer in software [to provide] more operational flexibility."³¹ The Kindle offers a similar logical representation of the book in software, extending beyond facsimile privileged by formats such as PDF. As a result, ebooks model books, while other formats model text or print. This logical representation requires additional features to differentiate a book from other digital written genres such as journalism or blogging. For example, EPUB extends the base HTML specification by introducing new tags including "spine" and font obfuscation to simulate the affordances of the book removed by text-oriented specifications. The Kindle was the first ebook platform to focus on virtualization rather than offering a flat

representation of print, complementing its precursor. The flexibility of cloud computing, which moved ebook infrastructure from on-device to remote storage, also created opportunities for reading surveillance on an unprecedented scale. Virtualization services such as AWS are an essential component to the Kindle's success, as they encapsulate both the product and the process. The practice enables the complex modeling of the book trade and a way of integrating the structure of the book trade into a relatively underpowered computer.

The Rhetoric of “Innovation”

Beyond AWS, Amazon has invested heavily in new technologies. The five largest technology companies (Alphabet, Amazon, Apple, Facebook, Microsoft), known as the “Big Five,” use the rhetoric of innovation to compete in the marketplace. This manifests in prizing start-ups and disruption over focusing on improving existing products and processes. Technology companies use research and development as a central strand of their marketing strategies. For example, in an interview on *60 Minutes* and a promotional website in 2013, Bezos revealed plans for “Amazon Prime Air,” a drone delivery system, before the technology was approved for testing.³² The announcement was a statement of intent designed to build excitement and increase share prices rather than demonstrate meaningful innovation. Seven years later, the company is still performing closed tests in Cambridge, England. Amazon faced greater barriers to entry into an increasingly restricted drone airspace, leading to further delays, but the reveal of speculative technology so far in advance of its implementation is highly unusual for a company like Amazon. Beyond this big marketing push, patent filings, acquisitions, and academic collaborations provide a more meaningful insight into how Amazon frames its role as a technology company, as such documentation provides evidence of unfinished and abandoned ideas. Alessandro Delfanti and Bronwyn Frey used Amazon's patent filings to explore how the company explores the future of work in an example of how this gray literature helps illuminate corporate ideologies.³³

The company's famed secrecy prohibits engineers from producing material for academic journals and conferences in line with its main rivals.³⁴ Academic collaborations are often local and outside the company's main business interests. For example, Amazon maintains strong links with the University of Washington, endowing the computer science department with two chairs in machine learning, and running the general Amazon Catalyst research fund for any initiative looking for funding at

the university.³⁵ The first rounds of Catalyst provided funding for projects as diverse as health, 3D printing, renewable energy, and robotics. Amazon Web Services offers an open credit scheme for educational projects to train future engineers.³⁶ Despite this gesture toward openness in the broader scientific community, this segmented access separates Amazon's core businesses from academic collaborations, unlike the open nature of Microsoft Research or Google and Facebook's interactions with universities. The company's collaboration with academics therefore offers little useful insight into Amazon's infrastructure.

Acquisitions are more fruitful for understanding Amazon's position in the technology marketplace. The company's first acquisitions in 1998 were PlanetAll, "a Web-based address book, calendar and reminder service," and Jungle, "a leading provider of Web-based virtual database technology, which allows visitors to access a variety of products sold by other merchants."³⁷ The two start-ups were acquired for infrastructure purposes instead of adding a flashy new service direct to customers. A year earlier, Bezos's first letter to investors gestured at this interest: "The Company's current strategy is to focus its development efforts on creating and enhancing the specialized, proprietary software that is unique to its business and to license commercially developed technology for other applications where available and appropriate."³⁸ Acquiring businesses to license technology was the first shift in the company's priorities from retail to providing infrastructure for third parties.

Amazon's patents are its most public statement of intent regarding technological and infrastructural innovation. The company was one of the top twenty most successful patent applicants in 2018 in a list dominated by hardware manufacturers including Samsung, Qualcomm, Intel, and Taiwan Semiconductor.³⁹ Lab126's focus on hardware increased the rate of patent filings, but Amazon also continued to protect algorithms and software. This diversity reveals what kind of hardware the company is developing, as well as many of the processes underlying these developments. Patents therefore are useful markers of Amazon's technological progress.

Bezos's early patent filings were controversial, particularly "Method and system for placing a purchase order via a communications network," filed in September 1997 and granted exactly two years later.⁴⁰ The innocuous title belies the much-contested patent's claim that Amazon was first to develop the one-click payment option for web-based retail. The technology allows users who have entered their personal details and credit card information to choose to buy something without requesting confirmation. Users would not have extra steps to confirm their purchase and reconsider the decision, thus replicating impulse purchases in brick-and-mortar

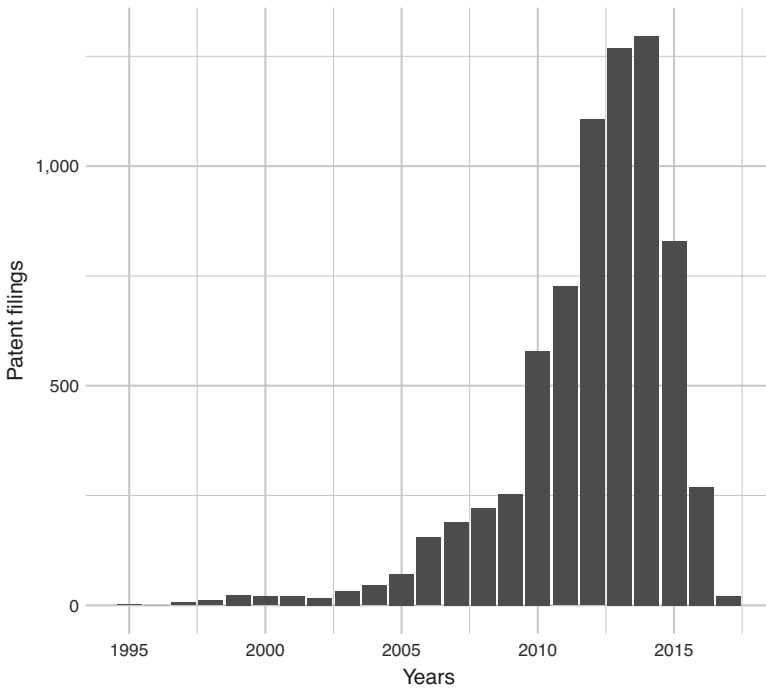
stores. The patent caused immediate concern within the technology community, drawing criticism from Tim O'Reilly, an influential computer guide publisher, and Richard Stallman, an early free software advocate, who viewed the patent as an implementation of preexisting HTTP cookies rather than a substantially new idea.⁴¹ While cookies were originally designed for Netscape Navigator, David Kristol and Lou Montulli's Internet Engineering Task Force Request for Comments (RFC) "HTTP State Management Mechanism" proposed an interoperable standard for articulating "stateful sessions with HTTP requests and responses."⁴² In other words, cookies enable servers to identify returning visitors along with limited information about their previous visits. The initial RFC mentioned web retail as a possible implementation alongside personalized journalism recommendations. Paul Barton-Davis, an early Amazon programmer, opposed the patent, which he believed was contradictory to the principles of open technology driving the web's early development as well as Amazon's early ethos.⁴³ Bezos rejected the claims, stating that "the vast majority of our competitive advantage will continue to come not from patents, but raising the bar on things like services, prices, and selection," but he agreed that software patents should be protected for a shorter time and agreed to fund a prior art database that never materialized.⁴⁴

The controversy did not slow Amazon's patent-filing policy, as it has been granted over eleven thousand applications since 1997, revealing a gap between ideology and practice in the company's technological development. For example, Lab126 filed seven patents related to the Kindle 1 simultaneously in March 2006, more than eighteen months before the device was launched. The seven patents feature the same context and diagram but diverge in the claims made, outlining separate processes and innovations from the shape of the device to its cloud-based delivery. As an illustration, "Handheld electronic book reader device having asymmetrical shape" reveals Amazon's interest in ebooks in 2006 and how this was reshaped by the attrition of the application process in its final iteration in 2016.⁴⁵ The original application made seventy-one claims, which were whittled down to twenty in the accepted application. The delays revolved around contentions over the similarities between the proposed wedge-shaped reading device and a patent filed by Nokia in 2002.⁴⁶ In response, Zehr and Whitehorn emphasized the media specificity of the invention by focusing on ebooks rather than the original claims for "electronic media," as well as the specific hardware configuration of four screens in nonparallel structures and the wedge's specific angle, which replicates a folded-back paperback. Zehr and others at Amazon sought to claim the design was unique among mobile computers, but this was narrowed to outline how

the Kindle was distinct from competitors including the Sony Librie, which did not feature four screens or a wedge shape. From the outset, Amazon was thinking beyond e-readers to position itself as a media hardware producer by using the language of “media” rather than “books” in these early patents. An e-reader was just the logical starting point, as Amazon was well established as a bookseller.

Patent applications are expensive, but Amazon does not implement all granted techniques, such as the abandoned “tactile member” page turner discussed in the previous chapter.⁴⁷ The company is renowned for investing profits into growth: investment in “technology and content,” which also included the cost of AWS and Prime Video, topped \$29 billion in 2018.⁴⁸ While patents may not offer the greatest return on investment, the company’s patent filings explore new opportunities without committing to launch. As a result, the patents are scattershot rather than focusing on one facet of Amazon’s business. For example, on June 27, 2017, the US Patent and Trademark Office granted Amazon thirty-seven patents in its weekly update. Most of these applications were submitted between 2013 and 2015, with four applications dating back to 2011–2012. The four older applications featured contentious broad claims. For example, “Public-domain analyzer” was filed in December 2011 as part of Amazon’s drive to offer free access to titles with expired copyright terms. Copyright law changes, particularly since the late twentieth century, have made discovery of these titles challenging. The patent outlines a method of identifying relevant titles through consulting metadata and generating a “confidence level whether work is in [the public domain of] a country.”⁴⁹ The published patent is commonsensical, since the public domain analyzer relies on Amazon’s metadata and proprietary algorithm, it primarily claims territory. Other patents granted on June 27, 2017, are more detailed and span the range of Amazon’s current service interests, including improvements to its data centers,⁵⁰ Alexa,⁵¹ and the backbone of its emergent drone technology.⁵² The applications were in process for variant amounts of time, so any connections are serendipitous, but the volume and scope indicate the extent of Amazon’s experimentation in different industries.

Amazon’s patent filings accelerated during the Kindle’s development cycle as the 1,000 patents filed before 2007 were dwarfed by 6,000 awarded in the decade afterward (figure 2.1). Examiners and inventors work together to classify patents into standardized categories to position the invention within broader technological trends. Patent offices continuously update the classification system, but it lags behind innovation in digital media.⁵³ As a consequence, the most frequently occurring classification number remains the default “1/1” option, which appears in

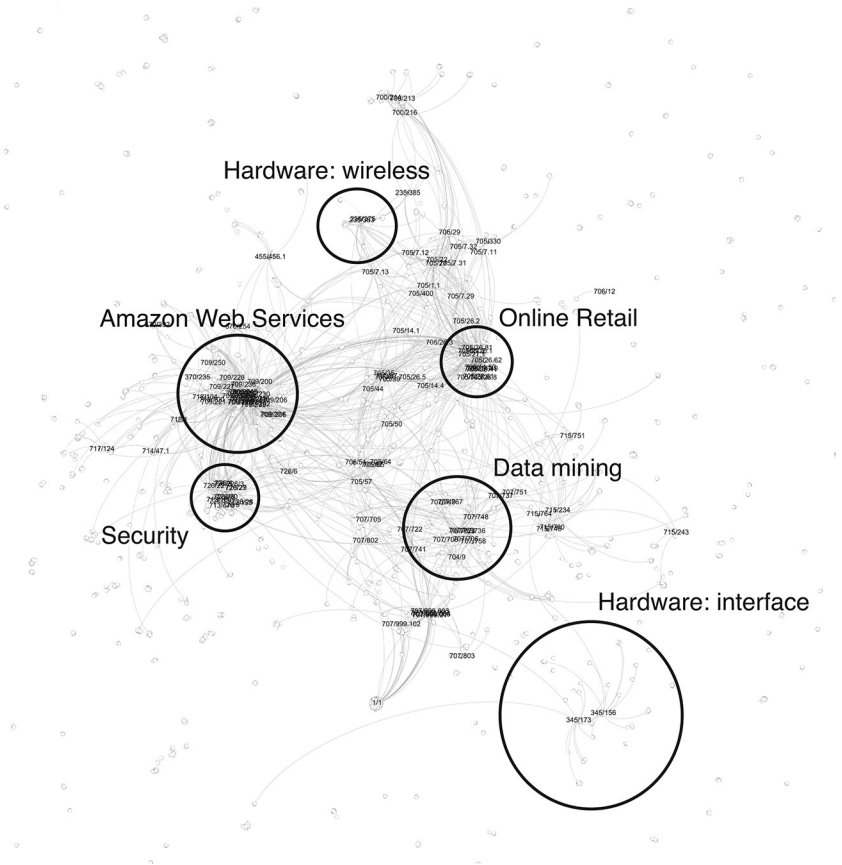


2.1 Amazon's granted patent applications, 1995–2017

1,600 applications, albeit often with other numbers. A closer examination of classification patterns offers a clear overview of Amazon's R&D interests: it has over seven thousand classifications in the data-processing range (700–715), including “data processing: financial, business practice, management, or cost/price determination” (705) and “multicomputer data” (709), reflecting Amazon's strengths in retail and cloud computing respectively. Eighty percent of all classification numbers come from the 700 range, which encompasses computational innovations, but the company also filed 14 percent of its patents in the 300 range, used for general hardware and electronics. Many of these patents focus on optical and image analysis, which is not traditionally seen as one of Amazon's strengths, but the patents outline optical character recognition (OCR) techniques and approaches to improve the visual sensors for devices such as Echo Show.⁵⁴ The hidden layers of Amazon's infrastructure are more expansive than the visible. In mid-2018, the optical recognition technologies documented in the patents were highlighted in Amazon's controversial collaboration with US police departments in Florida and Washington using Rekognition, its facial recognition technology.⁵⁵ Likewise, the patents related directly

to the Kindle represent only part of the broader set of technologies that underpin the device.

Amazon’s modular infrastructure becomes clear when we look at the connections between classification numbers in its patents. Figure 2.2 shows a network of classification numbers for the company’s patent applications between 1997 and 2011. Several themes—security, data, and wireless—emerge as important across Amazon’s services. AWS and online retail have a fingerprint in patents clustered around networking and retail respectively. As the company’s public image depends on retail technology, this can be seen as “offensive and defensive weapons in legal struggles with their competitors,” or a way to stake Amazon’s territory.⁵⁶ Even with the densely connected clusters of classification numbers, patents tie together disparate elements of Amazon’s infrastructure, reinforcing the



2.2 Network of patent classifications

modularity of the company’s interests. Engineers working on drone delivery and groceries do not work in silos but build technologies that reinforce the company’s overall strengths. The Kindle benefited from this approach, as it combined expertise in networks, wireless, retail, and data mining. The mass connections between separate classifications indicate a modular yet interconnected approach to technological innovation.

Table 2.2 maps Amazon’s trajectory from a web-based retailer to infrastructure provider through identifying the most prominent words in patent filings over three-year intervals. The patents diversify over time and offer a narrative of the company’s development. Amazon’s first patent application, “Secure method for communicating credit card data when placing an order on a non-secure network,” filed by Bezos alone in March 1995, reveals the lack of trust in web-based retail at the time.⁵⁷ The patent cites publications such as “Perils and Pitfalls of Practical Cyber-commerce” that outline a range of obstacles for online retail, including cryptography, impersonation, and growth management.⁵⁸ It describes a transitional system between telesales and online retail to instill trust by separating the order and payment systems. Users would submit an order online and then “during a subsequent telephone call to the remote merchant location [enter] the complete credit card number.” The information would be automatically processed on a secure internal server.⁵⁹ The idea appears quaint two decades later, but this early patent signaled Amazon’s

Table 2.2 Three-year moving average keywords in Amazon’s patent filings

1995–1997	1998–2000	2001–2003	2004–2006	2007–2009	2010–2012	2013–2015
card	auction	pay	task	computing	device	inventory
credit	search	content	storage	network	data	producer
associate	gift	marketplace	embodi- ments	virtual	session	second
data	items	fulfillment	configured	device	storage	holder
order	recipient	page	data	module	gateway	first
said	bid	inventory	WS	can	power	crypto- graphic
telephone	item	product	traffic	communi- cation	blob	electro- wetting
point	terms	image	tasks	DNS	antenna	parsed
purchaser	category	listings	path	address	element	leasing
confidential	facility	plan	mobile	execution	NCC	fluid

See appendix A for further details.

ambitions to build trust in online retail by revising the dominant model of retail for a web-based environment.

Just three years later, customers were comfortable enough to use Amazon. The technological arms race shifted toward developing auction technologies such as the 2002 patent “User interfaces and methods for facilitating user-to-user sales” to compete against the emergence of eBay, which began applying for patents in 1998. In the patent, Roseman et al. emphasize Amazon’s strengths in using metadata to generate recommendations for users and speculate about asking customers to “pre-order” items by indicating the maximum they were willing to pay.⁶⁰ Outside the more outlandish claims, the illustrations demonstrate how little third-party retail services have developed over the last two decades, since the design matches the marketplace today.

The third phase in Amazon’s patent filings was more substantial as the company began to file patents relating to ebooks and other hardware, including tablets, phones, and voice-activated assistants. The terminology shifted from “ebooks” to “digital content.” This is emphasized in patent applications such as “Method and system for providing annotations of a digital work,” which forms the basis of Amazon’s Kindle Popular Highlights system and was further expanded into the X-Ray service for ebooks, films, and music.⁶¹ As Amazon built a reputation as a media technology company, its patents began to reflect the company’s interests in media beyond books. Patents aimed to cover film, streaming, video games, and ebooks, leading the company to adapt the term “digital works.” For example, “Playlist-based detection of similar digital works and work creators” lists “music files, video files, [and] electronic books” mediated through sources including “web sites” and “physical CDs.”⁶² Amazon’s move into other creative industries encouraged cross-fertilization of media metaphors, as the patent was an extension of one filed in 2001 called “Recommendations and services based on works played or stored on user devices.” Amazon’s infrastructure treats the book as one medium among many interacting with its systems. The company does not privilege the book above other commodities but treats it as another product to sell and accumulate data from. This approach exemplifies what Shoshana Zuboff calls *surveillance capitalism*, which “unilaterally claims human experience as free raw data for translation into behavioral data.” These data can be converted into “prediction products” but have increasingly been “traded in a new kind of marketplace for behavioral predictions [called] *behavioral futures*.”⁶³ The speculative nature of this project ensures that Amazon collects all possible data from bookselling and consumption with the aims of monetizing it later. Mark Davis describes this overreach as Amazon

bringing the act of reading into the market.⁶⁴ As I have argued elsewhere, premature marketization of reading data can only be as effective as the analysis, which has yet to result in clear benefits for Amazon, publishers, or readers.⁶⁵

Retail Infrastructure

Amazon's early development relied on a mixture of retail innovations and leveraging new logistics and warehousing technologies. The company's logistical strength led to the development of its Prime service and the erosion of waiting times to Prime Now (one-hour shipping in select cities in the United Kingdom and United States). While it has an extensive network of warehouses in strategic locations, this physical infrastructure is underpinned by the company's data-processing capacity to ensure that items are in the right warehouses to meet tight delivery schedules. Amazon's recent interest in drones and warehouse robots reflects a natural progression to focusing on automating the retail process. The outward-facing emphasis of progress in automation masks the vast network of contingent labor working to meet the tight deadlines of deliveries in less than forty-eight hours.

Before Amazon built a sophisticated warehouse and distribution network, the company relied on an artificially inflated catalog to give the appearance of a large bookstore. At launch, it needed to attract Borders and Barnes & Noble customers without having a comparable warehouse. While the start-up did not have the same brand recognition, Amazon developed advanced supply chain technology to become far more efficient than its brick-and-mortar rivals.⁶⁶ For example, the layout of its warehouses changes to meet the demands of changing customer orders rather than remaining static. Bezos initially decided against warehousing stock but preferred to list titles as available and order books from wholesalers on request, passing part of the savings onto customers.⁶⁷ This approach was unsustainable, and as Amazon grew, it began building warehouses for popular items to reduce waiting times. By 2017, the company amassed an extensive international warehouse network of almost 200 million square feet.⁶⁸ Amazon's vast footprint has a large environmental impact for the sole benefit of faster shipping. Prime delivery worked through stocking goods in strategic locations, although its data-driven approach to rolling out shorter shipping times reinforces racial and class divides in major US cities.⁶⁹ Amazon Prime was initially seen as a risky proposition, since shipping fees can be lucrative, but it reaped \$1 billion in membership fees during the first year of operation.⁷⁰ Prime was a Trojan horse for Amazon's

broader plans to turn retail customers into users of the full suite of Amazon services. Subscribers soon gained access to premium Twitch, music, and video services while receiving discounts for specialist retail operations including Pantry, a home delivery grocery service. In the 2016 report to shareholders, Bezos describes Prime as one of the three pillars of Amazon alongside Marketplace and AWS.⁷¹ All three services form the blueprint for Amazon's "walled garden," where users can access the majority of services required on the internet.⁷² Schemes like Prime invoke a fear of sunk cost, where customers are more likely to purchase something via Amazon to make the most of the membership fee even if the product is cheaper elsewhere.

By encouraging users to see Amazon's ecosystem as an interconnected suite of services, Prime has become central to the company's business-to-consumer offerings. In this sense, Prime functions as a service infrastructure, offering a common base for consuming Amazon services that discourages users from moving to another platform. The subscription service permeates all parts of Amazon, including the Kindle. Two subscription services are available for the ebook platform: Prime Reading and Kindle Unlimited. The latter offers a fuller library at an additional cost, but Prime members gain the benefits of the former. Both schemes aim to change readers' consumption habits so that they remain Kindle-only readers. If many exclusive ebooks cost only a couple of dollars, and Unlimited costs \$9.99 to access the same content, users are encouraged to read up to five books a month to make the most of their membership.

Amazon invested in online retail infrastructure to build a reputation in an underdeveloped niche. The company was keen to shift to a service-oriented business model early in its development. While Amazon struggled through the malaise of the dot-com bubble in 2000, Bezos suggested that the company might become "an incubator for e-commerce companies that can start companies at lower costs and more quickly than any other company in the world."⁷³ The rhetoric was toned down in future press releases, but the ethos remained throughout the development of third-party retail services starting with zShops in 1999. The service provided the blueprint for today's third-party marketplace by allowing merchants to "offer a vast array of popular or hard-to-find items" on the web store.⁷⁴ The storefront merged with Amazon Auctions, a failed attempt to compete with eBay, to form the current marketplace.

Traditional retailing wisdom suggests that allowing third parties to sell direct to consumers undercuts sales, but Amazon understood the importance of transaction logs as a commodity. Businesses have taken advantage of its infrastructure for third-party retail. For example, Thriftbooks

sells books for under a dollar and sells up to twelve million books a year via Amazon through rescuing “landfill-bound books, sight unseen, for around 10 cents a pound.”⁷⁵ The most successful operations employ data scientists and financial analysts to find the most profitable books. Amazon benefits from the data to enhance its recommendation algorithms, identifying older titles to bring to the Kindle and pocket transaction fees without the need to warehouse items. In 2006 the company launched Fulfillment by Amazon (FBA) to allow third parties to use its warehouse and delivery infrastructure.⁷⁶ FBA reflects Bezos’s focus on scale: Amazon warehouses are larger than any third-party start-ups’ storage facilities, so both parties will mutually benefit by using this scale to market to a large user base. The scheme also allowed Amazon to recoup the shipping costs lost through Prime subscriptions, as third parties pay the company to store and deliver the items. The ability to target both end users and businesses as customers was replicated in the development of the Kindle, as Amazon could use its large customer base to encourage publishers to digitize books that remained out of print but interested users. FBA is just part of Amazon’s shift from service provider to service infrastructure, where scale and volume are more important than limiting direct competition. In his 2017 letter to shareholders, Bezos noted that over half of all products sold through Amazon were sold by third parties, cementing the company’s importance as web retail infrastructure.⁷⁷ Ben Thompson argues that Amazon is interested in developing an infrastructure for all retail activity and transactions rather than focusing on one business model, no matter how contradictory those motives might appear externally.⁷⁸

The introduction of Amazon Pay in 2007 to compete with PayPal expanded the company’s transaction log data beyond the confines of its own retail website to gather further evidence of consumer habits across the web.⁷⁹ Aiming to leverage the company’s reputation for secure payments, Pay never reached the same customer base as PayPal, despite Amazon’s substantial market share in retail. PayPal is a direct competitor, and its user base may support it instead of Amazon and may boycott the company. The so-called Everything Store is designed to be comprehensive, so loyal customers have little need to shop elsewhere. Amazon Pay shows that the company’s infrastructure has its boundaries and outside of the hidden use of AWS, it is less likely to succeed outside of Amazon’s core service infrastructure.

The internal retail operation was far more successful. Bezos capitalized on the fact that brick-and-mortar bookshops would never be able to compete with Amazon’s ability to cater to the demand of the “Long Tail,” the model that 90 percent of all interest comes to the top 10 percent of

most popular items, while the final 10 percent of interest is spread thinly through the remaining 90 percent of items.⁸⁰ In bookselling, this is the distinction between best sellers—titles that sell large quantities in a relatively short period—and the backlist, older titles that sell steadily if left visible in a store. Brick-and-mortar bookstores traditionally chase best sellers rather than selling older titles, which can only feature limited stock, as booksellers must ensure all books will sell in a reasonable period. Brick-and-mortar retailers rely on “core stock” such as *The Highway Code* and *The Hobbit*, which are likely to sell consistently over time. Conversely, Amazon’s extensive warehouse network and online catalog allow the company to profit from obscure titles hidden from traditional bookshops’ customers. A store with over four million unique titles can be unruly unless tamed by a search bar. The runaway success of best sellers such as a new *Harry Potter* title allows Amazon to offer such books at a heavy discount, thus attracting more new customers. Amazon’s catalog of sixty-five million other books props up discounting practices even if each only sells a single copy a year.⁸¹ The company’s data collection practices allow it to profile networks of users’ interests in niche genres and provide recommendations from the end of the long tail.

In 2016, Amazon transitioned from online to physical retail by opening its first bookstore in Seattle, followed by other branches across the United States. Ironically, it wished to avoid another company undercutting its physical retail and filed a patent in May 2012 describing a method for blocking customers’ access to competitors’ prices when physically in a store.⁸² The company had previously benefited from this phenomenon, as browsers refer to Amazon’s app for price comparisons when in the competitors’ shops, and the patent is a defensive tactic for ensuring other retailers did not develop similar technology. Amazon Books’ aesthetic revolves around the importance of user-generated data and replicating the technology of online retail in a physical space. For example, Prime customers received in-store discounts, while those without the premium service pay full list price for in-store purchases.⁸³ Curated displays drew on user-generated data, with shelves dedicated to esoteric categories including “4.8 Stars and Above” and “Most-Wished-For Books.” Rather than work with traditional product categories, Amazon wished to experiment with new models of discoverability, drawing attention to its data structures rather than broader trends within publishing.

Amazon’s entry into physical grocery sales with the launch of Amazon Go in December 2016 and acquisition of Whole Foods in June 2017 marked a broader commitment to brick-and-mortar retail. The Whole Foods acquisition provided Amazon with a large and loyal grocery

customer base, as well as the preexisting infrastructure to intervene in grocery home delivery. Whole Foods' distribution network would provide the foundation for Amazon to enter the notoriously difficult grocery market and pivot away from strengths in nonperishable goods. Amazon Go's launch demonstrated the extent of Amazon's ambitions in physical retail through a provocation about the future of grocery shopping with the emergence of the internet of things, or a new wave of technology with native network functionality. Amazon Go is marketed as "a new kind of store with no checkout required."⁸⁴ The generic title belies the fact that the company's first checkout-free store focused on food rather than books. RFID (radio-frequency identification) technology is pervasive in libraries, which lessens the perception of checkoutless book shopping as "magic." Amazon Go's food retail operation mixes AWS, internet of things, and knowledge of users' purchase history to create a digital experience in a physical retail space. A *New York Times* report on the first location's launch noted the abundance of cameras present on the store's ceiling, indicating the importance of facial and product recognition over a more convoluted internet-of-things solution.⁸⁵ While Amazon has expanded far beyond its original bookstore, the company continues to explore the role of digital infrastructure in retail as both a service for other businesses and a method for data collection.

The launch of AWS in 2006 marked a consolidation of Amazon's philosophy for virtualizing infrastructure even if doing so undermines the company's previously profitable ventures. The approach allowed Amazon to shift from being a retailer to a retail platform, letting third parties use its extensive warehouse and delivery infrastructure. The launch of the Kindle saw the equivalent shift in Amazon's approach to books. Before 2007, Amazon was a major online retailer through its reputation for books, but this model was unsustainable. Since the Kindle had no major competition in the mid-2000s, it offered the opportunity to create *the* infrastructure for digital book distribution, mitigating any potential drop in physical books sales from Amazon. After an initial push with hardware, a move toward emphasizing infrastructure has made the Kindle vital to the future of screen reading, reflecting its position in digital and off-line cultural more broadly.

This is a section of [doi:10.7551/mitpress/11985.001.0001](https://doi.org/10.7551/mitpress/11985.001.0001)

Four Shades of Gray

The Amazon Kindle Platform

By: Simon Peter Rowberry

Citation:

Four Shades of Gray: The Amazon Kindle Platform

By: Simon Peter Rowberry

DOI: 10.7551/mitpress/11985.001.0001

ISBN (electronic): 9780262369114

Publisher: The MIT Press

Published: 2022

The open access edition of this book was made possible by generous funding and support from MIT Press Direct to Open



The MIT Press

© 2022 Simon Peter Rowberry

All rights reserved. No part of this book may be reproduced in any form by any electronic or mechanical means (including photocopying, recording, or information storage and retrieval) without permission in writing from the publisher.

The MIT Press would like to thank the anonymous peer reviewers who provided comments on drafts of this book. The generous work of academic experts is essential for establishing the authority and quality of our publications. We acknowledge with gratitude the contributions of these otherwise uncredited readers.

This book was set in Filosofia OT by Jen Jackowitz. Printed and bound in the United States of America.

Library of Congress Cataloging-in-Publication Data

Names: Rowberry, Simon Peter, author.

Title: Four shades of gray : the Amazon kindle platform / Simon Peter Rowberry.

Description: Cambridge, Massachusetts : The MIT Press, [2022] | Series:

Platform studies | Includes bibliographical references and index.

Identifiers: LCCN 2021013279 | ISBN 9780262543507 (paperback)

Subjects: LCSH: Kindle (Electronic book reader) | Electronic book readers.

| Electronic books.

Classification: LCC Z286.E43 R689 2022 | DDC 004.1675—dc23

LC record available at <https://lcn.loc.gov/2021013279>

10 9 8 7 6 5 4 3 2 1