Colonial Topographies of Internet Infrastructure:
The Sedimented and Linked Networks of the Telegraph and Submarine Fiber Optic Internet

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In 2015, the Government of India announced that digital infrastructure, and specifically high-speed Internet service, was a "core utility to every citizen" as it was a requirement for the full ecology of digital services and platforms to be launched under the Digital India program (2018). Almost all these new initiatives ranging from e-government services to mobile banking relied on high speed Internet availability. High-speed Internet was necessary, the government proposed, to "transform India into a digitally empowered society and knowledge economy" (Digital India website 2018). While the techno-utopian underpinnings of the Digital India program posing technological solutions to social, economic, and political issues affecting the nation-state, have been critically examined elsewhere,[1] I am more interested here in the framing of digital infrastructure as a universal service. First introduced as a national and corporate goal in Indian telecommunications by the National Telecom Policy in 1994, universal service was defined as "the provision of access to all people for certain basic telecom services at affordable and reasonable prices" (NTP 1994).

Accessible and affordable services to all citizens has been a hallmark of universal service, and the emphasis on citizens rather than communities (for example, private telephone lines rather than public phone booths) has made the project both ambitious and somewhat incomplete since it was introduced. While universal service was initially advocated for the telephone, newer policy proposals by the Government of India have shifted its focus to Internet connectivity (Thomas 2012, 65). This reiteration of a universal service obligation, to offer all Indian citizens a baseline of

[1] See for example, Gurumurthy, Chami, and Thomas' article (2016) on the connection between the Digital India program and authoritarian neoliberalism.

consistent Internet access, came shortly before the United Nations adopted a resolution in 2016 (UN Resolution A/HRC/32/L.20) affirming a "human rights-based approach in providing and in expanding access to the Internet" and advising governments that internet access had become crucial to human rights in this digital age (UN Resolution A/HRC/32/L.20). Whether framed as a universal service or as a human right, Internet access is thus placed under the ambit of national governance, with expectations that state governments have some obligation to improving and protecting it.

These expectations about Internet access, and ensuing government programs intended to remedy the digital divide, while laudatory, call for Internet infrastructural development within the borders of the territorial state – despite the fact that these infrastructures and the protocols and politics imbricated within them are both transnational and historical. Framing digital infrastructure as "networked and layered," this article thus takes a long historical view to uncover the substrate atop which our contemporary transnational Internet infrastructure, namely the fiber optic undersea cable network, was built (Mattern 2018, 320). In 2017, these cables, constituting a key element of the material infrastructure of the Internet, comprised of just about 428 known submarine cables responsible for over 99% of Internet connectivity in the world (Telegeography 2018). The outsize role of these submarine cables in shaping global communication merits close attention to their ownership, management, and political ties to nation-states.

This article reads this undersea Internet infrastructures in the historical context of British colonialism, linking contemporary development efforts to the invention and spread of the telegraph networks under British colonialism in the 1800s, particularly in colonial India. I start by writing what Sandra Harding (2009, 405) has called a counter history "of the achievements of modern Western sciences and technology," and first sketch the dependence of telegraph networks on

exploited native labor and natural resources extracted from British colonies – in other words, elements made available to British scientists and technologists through the violent project of colonization. Second, I argue that the colonial topography of the telegraph (its material infrastructure, undersea pathways, and the colonial ideologies and policies which propped up that network) constitute a colonial topography that has been inherited by the submarine fiber optic infrastructure of the Internet. The telegraph and fiber optic networks are bound in their very materiality: the intercontinental architecture of the Internet adopted the undersea pathways and cable landing stations established for the telegraph. [2]

Given the exploitative conditions which created the telegraph network, and its use as a technology of colonial control in colonial India and elsewhere, this inherited colonial infrastructure is past due for decolonization. If computing is, as Syed Moutafa Ali argues (2016), "necessarily colonial *insofar as it is modern*" and that it is "founded upon, and continues to embody aspects of colonialism," then the infrastructure of the Internet, the very structure and attendant racial epistemologies on which computing rests, is an important site for decolonial thinking and practice. Globally, we are too entrenched already in the collective Internet infrastructure to divest from it entirely, despite the oppressive colonial networks which prefigured it and its continuing inequities today. While there have been movements like #DeleteFacebook asking users to deconnect from digital platforms bound up in neoliberal and oppressive agendas, our global communication networks rely too much on the undersea cable network to be delinked from them.

[2] I am not suggesting here that policy makers, technologists, and scholars are unaware of colonial era communication networks. Gopika G.G. (2014), for example, offers a detailed historical account of the telecom industry from the introduction of the telegraphs in India to privatization in the 1990s. I propose, however, that the telegraph cannot be parceled off as a completed and past project – even if the cabling has changed and telegraphy has fallen into disuse, the telegraph networks remain live today, and the sedimented history of the telegraph must be uncovered so that we may understand how it introduces geopolitical inequities into the Internet infrastructure.

Instead, I take up Roopika Risam's (2018) call to "use technologies to undo the technologies of colonialism" as a means of redressing the harm and aftereffects of colonialism in computing and other spheres of postcolonial life (80-81). I thus conclude this article by offering the example of the SEACOM cable line (connecting East Africa, the Middle East, and South Asia) as both an indicator of and a model for a decolonization project already underway in the undersea communication network. While this article focuses on colonial and postcolonial India, and what P.P. Sneha has called the "chequered and uneven history of the growth of science and technology in India," it necessarily follows the transnational cable pathways to other geopolitical contexts in the Global South (Mapping Digital Humanities in India, 2016). The oceanic corridor between East Africa, the Middle East, and South Asia, in particular, has been the site for both colonial interventions in telegraphy as well as more recent decolonial infrastructural projects led by local communities and telecommunication companies. Finally, I hope that this article will decenter the Euro-American outlook of the field of digital humanities by turning to the techno-social histories, colonial landscapes, and communication networks and practices relevant to the Global South. Above all, I am invested in Internet infrastructures not as technical developments, but as sociocultural assemblages capable of shaping people's lives in the Global South.

The History of the Internet Begins with Gutta Percha

The history of the Internet is generally traced to a nexus of scientific and military interests in the 1960s, when ARPA, today known as DARPA (Defense Advanced Research Projects Agency)[3] funded an early form of computer networking called Advanced Research Projects Agency Network (ARPANET). As an initiative of the U.S. Department of Defense, ARPA's

[3] While this history of the Internet is relatively well known, see Naughton (2016) on the transition of the Internet from a Cold War era military experiment to a commercial and civilian project.

investment in computing technology occurred against the backdrop of the Cold War, and the overall state and military imperatives of the United States to gain a strategic edge over Soviet Russia. While the history of the Internet is generally traced to this set of events in the 1960s, I broaden this historical span to the mid nineteenth century when the first underwater telegraph lines were laid in 1851. Although the two technologies developed independently of each other, the co-histories of these two technologies show uncanny parallels, as both telecommunication technologies were scientific innovations deeply tied to the anxieties and ambitions of the empires which invested in them. The telegraph network, colloquially labelled the "Victorian Internet" today, was dominated by British companies, mapped onto the British empire and dispersed along nodes of military and strategic importance to the colonial administration (Standage 2014, IX).

This section traces the inextricable connections between exploitative colonial conditions and the development of the telegraph network as the prehistory of the Internet infrastructure. The international dispersion and feasibility of telegraph lines would have been impossible without the trifecta of military power, extraction of resources from the colonies, and native labor brought together by the British empire. After successful experiments on telegraphy at the beginning of the nineteenth century in Europe and America, undersea telegraph lines became a major commercial interest for British telegraph companies after 1851. This dramatic shift in scale, from a domestic technology to an international one, and the British monopoly in the business, was propelled by a raw material known as gutta percha that turned out to be the only durable insulating latex for the underwater cables. Gutta percha enabled the creation of the undersea telegraph network which would later become the foundation for the fiber optic Internet network.

Calling gutta percha the "sine qua non of the success of the undersea telegraph project," Tully (2009) estimates that the cable industry (mainly controlled by British companies)[4] destroyed 88 million gutta-percha trees between 1857 and the early 1890s for the telegraph network (575). Native to the Malay Peninsula (modern day Malaysia, Thailand, Myanmar, and Singapore), gutta percha was a tree sap discovered in the fashion of many other colonial discoveries: a native man (whose name remains unrecorded in the archives of empire, but who is generally reported to be a Malay man) shared his local, indigenous scientific knowledge of the substance's chemical properties with a white colonial officer, and this officer subsequently introduced it in British society and was credited for discovering a substance which would change the international telegraph industry (566). The extractive economy of gutta percha harvesting pressed native labor and natural resources into an exploitative and ecologically unsustainable project of Western modernity.

The international expansion of the telegraph lines enabled by gutta percha was neither apolitical nor universal, and despite its reliance on native labor and resources, the telegraph was not an accessible technology for most colonial natives. As Choudhury (2003, 49) notes in the Indian context, "the [colonial] government, media, and European-capital-dominated international businesses were the biggest users of the telegraph." John Pender, the so-called cable king who made his profits off the cable industry and later became a member of the British parliament, was famous for claiming that "telegraphs know no politics" (Choudhury 2010, 107).[5] Yet, the imperial

[4] Headrick (1991, 28) writes that the technology (of the telegraph) "encouraged the concentration of manufacture and control" as industrial nations "manufactured their own telegraphic equipment." Moreover, the British had several advantages over other nations until the early 1900s, including "a level of demand sufficient to warrant a cable industry," the "commercial and financial organization" to support that demand, specialized cable laying ships, and "colonies and islands in every ocean suitable for cable relay stations" (28).

[5] As I note later, such claims about the apolitical nature of scientific and communication technologies would also be made of the Internet.

and political nature of this new technology is strikingly apparent in colonial India, which served as a lynchpin in the international telegraph lines extending into East Asia and where domestic telegraph lines were considered paramount to colonial control of the Indian sub-continent. In India, a British East India Company officer known as William Brooke O'Shaughnessy had invented a telegraphic system in 1851 separate from the ones developing in Europe and America and later received funding from Lord Dalhousie, then Viceroy of India, to develop an internal telegraph network.

O'Shaughnessy's development of the telegraph in India is often narrated in colonial histories (and even in recent scholarship) as a matter of British modernity triumphing over hostile nature and the petty self-interest of Indian natives. Gorman (1971) writes, unironically, that "one has to admire O'Shaughnessy for his faith and confidence in deliberately choosing such formidable conditions of construction and operation" as he had to reckon with snakes, monkeys, elephants, rats, ants, swamps and lightning storms – even though O'Shaughnessy should have been well aware of these natural phenomenon and fauna given his tenure in colonial India (585). Moreover, he was plagued by labor troubles as "Indian workers first had to be trained to perform even the simplest tasks," and conflicts between the blacksmiths he employed and local villagers led to the latter "sabotaging the line" (585). Such disparagement elides, however, the necessity of native labor to the growth of the telegraph in India, and the transnational communication pathways built around Indian ports.

Although O'Shaughnessy's assistants and workers were not framed as intellectual collaborators and their participation in this seminal innovation did not yield the economic or social prestige afforded to O'Shaughnessy, their labor forms a key part of the telegraph project in India. Choudhury (2009) notes, for example, that O'Shaughnessy's telegraph fused "indigenous

metallurgical traditions and Indo-European skills" and relied on local skilled artisans to create the specialized parts needed for the telegraph (20). Such artisanal and creative labor of Indian natives was not deemed equal to the rational and scientific labor performed by the colonial technologists (including O'Shaughnessy) who would be credited with the invention of the telegraph. Such inequitable labor contributions were also visible inside the telegraph offices, where the lower ranked and underpaid peons and clerks were Indian, while the signalers were mainly white Europeans (Choudhury 2003, 54). Colonial India operated as a hierarchical knowledge economy: scientific and working knowledge about the telegraph was not openly disseminated[6] and the preferential employment of white Europeans as signalers further served to consolidate this knowledge.

The political nature of the telegraph network, and the use of the telegraph as a technology of colonial control became more apparent after the Indian War of Independence in 1857. In his biography of Dalhousie, colonial historian Sir William Wilson Hunter (1894) exclaims that the "railway and the telegraph were worth thousands of men to us in the Mutiny of 1857 and it is by the railway and the telegraph that India is now strategically held (199)." Hunter further proclaims that "an entirely new Empire was being called into existence" by the infrastructural initiatives instituted by Dalhousie in India, and the electric telegraph had become "the basis not only of our military policy in India, but of the modern mercantile system" (199). Weaponizing a scientific innovation, and investing in its reproduction with government funding, the colonial administration turned the telegraph into an instrument of control over territories, commerce, information, and above all, colonized people.

[6] This control over scientific dissemination was not restricted to India. Headrick (1991, 46) writes that the submarine telegraph network was not one of "technological diffusion" as the "cables spread to every continent, but the equipment and knowledge stayed firmly in the possession of a small elite, almost all British."

As a pre-eminent project of Western modernity, the telegraph was also framed within the civilizing mission of the British in India. Seeking to foretell the cultural transformation of India, Hunter (1890) writes that the telegraph was part of the "splendid, if…perilous, work" of "binding together the Indian races by a common system of education and by a community of interest, mercantile and political, which was altogether unknown in ancient India, and which forms the most significant feature of the India of to-day (196,199)." While eliding the mercantile as well as political networks which had existed in the Indian sub-continent prior to British colonization, this statement claims a connection between modernization and the emergence of a collective political consciousness. The racist subtext of the civilizing mission, however, was its assumption of natives as primitive, technologically deficient subjects bound to tribal (rather than modern) thinking. This colonial history of the telegraph also makes it clear that the civilizing mission was predicated on native subservience to white colonial authorities: the technology was first deployed to bring native population under the control of the British empires, and it was built upon and enabled the oppression of the same subjects it purported to enlighten.

Nonetheless, anticipating the role of the telegraph in what Benedict Anderson (1985) would later call the imagined community of the nation, Hunter's statement is ironic given the appropriation of the telegraph as well as the railways by nationalists and revolutionaries in the Indian independence movement. This radical repurposing had less to do with colonial intentions for how natives should use technologies on colonial terms and more to do with the political organizing that was undertaken in the late nineteenth and early twentieth century. The techno-utopian belief in Hunter's statement (about the unification of the Indian 'races') would be echoed later in similar tropes about the Internet. By networking the globe, the Internet was supposed to foster dialogue among individuals and lessen identify based conflicts. In techno-utopian narratives,

technologies and individual participation in their interventions are posited as the solutions for social, political, and systemic problems. A *New Yorker* cartoon by Peter Steiner (1993) once famously proclaimed that "On the Internet, nobody knows you're a dog," reflecting the notion of the Internet as a depoliticized space where markers of identify, including those of privilege and marginality, had been rendered redundant. And yet, as Nakamura (2002) observes, "supposedly "fluid" [virtual] selves are no less subject to cultural hegemonies, rules of conduct, and regulating cultural norms (4)." In the case of the telegraph as well as the Internet, technologies which radically altered global communication were imbricated in, rather than removed from, existing systems of power.

Technological progress gave the colonial administration a veneer of civility, and covered over the systemic violence at the core of all imperial projects. Thus, Hunter's account elides a crucial fact of colonial practice in India: the colonial administration saw the unification of the Indian peoples as a threat to its control over the sub-continent, and practiced a policy of divide and rule which would, among other factors, contribute to the Partition of the Indian subcontinent in 1947. Colonial authorities simultaneously championed the telegraph (and other communication and infrastructural projects) for uniting the Indian peoples while advancing policies to instill social divisions and fracture nascent alliances. These two ideological projects were not contradictory: rather, the policy of divide and rule was openly political, while the telegraph masqueraded as a technological project while being firmly rooted in imperial politics.

The cultural history of the telegraph that I have traced in this section points to a scientific innovation whose dispersion, internationally and in India, could not have been realized without colonial resources, native labor, and the impetus of native uprisings. Far from being a neutral technology, the telegraph was implicated in the bureaucracy of empire and in colonial

epistemologies. It was both, a source of tremendous profit for private British companies and a means of controlling the outposts of the British empire. As a result, the telegraph network spread through the world in uneven and hierarchical patterns, driven by the needs and markets of various imperial empires in the late nineteenth and early twentieth century. Moreover, in colonial India, techno-utopian narratives of the telegraph and its presumed benefits to the Indian people became part of the project of Western modernity, deeply tied to civilizing and modernizing the natives and helping them to move on from their distinct tribal affiliations into a civic body politic.

Locating the Sedimented Topography of the Telegraph in the Internet Infrastructure

The telegraph, its material infrastructure and the colonial ideologies and policies surrounding it, has continued to shape the Indian telecommunications landscape after Independence in 1947. When privatization led to the creation of the Telecom Regulatory Authority of India (TRAI),[7] in 1997, the founding act which brought this independent agency into existence referenced two colonial acts on the telegraph passed by the colonial administration to control the dispersion of the telegraph in India. The first, the Indian Telegraph Act of 1885, gave the colonial government sweeping powers in building and regulating telegraph networks in India, and the second, the Indian Wireless Telegraphy Act of 1933, prohibited the possession of a telegraphy apparatus without a license (TRAI Website 2018). These acts granted the colonial government control over the spread of telegraphy networks, and indirectly, control over commercial and military information. The passage of the latter act also coincides with a burgeoning independence movement in India, and ensured that the colonial government not only controlled who was granted

[7] As an agency with regulatory powers, TRAI decides telecom tariffs, issues policies regarding transparency and fairness in the telecom industry, and implements guidelines for developing the telecommunication sector in India. Its charge might be broadly understood as protecting the interests of Indian citizens.

a telegraph license but also knew who owned a license. The telegraph and its legal framework was thus folded into the surveillance regime of the colonial government. While TRAI's scope of operation would override these two colonial era acts, both acts constitute a legal precedent upon which TRAI's regulatory powers are based.

The lasting legacy of the telegraph, however, rests in the colonial topography it bequeathed to the global Internet network which followed it. While this topography encompasses the geopolitical materiality of cable lines, and the undersea routes on which these lines were laid, it also references the deep developmental inequalities instilled between the colonial empires and formerly colonized nations during colonialism and often exacerbated under neocolonialism; inequalities which continue to hinder nations in the Global South from owning and benefiting from the Internet infrastructure of the undersea cables. The Indian case is one of contradictions: the country has a number of global telecom companies with their own cable lines but has struggled to meet the assumed responsibility of universal service that I mentioned earlier in this article. In this section, I focus particularly on the transnational geographies of cable routes and cable stations in the Global South and on the concentration of cable ownership in the U.S. and Europe to illustrate a landscape of Internet infrastructure which frequently positions its Global South nodes merely as relay points to connect the rest of the world. While this infrastructure is global in its reach, it is, just like the telegraph network, bound to territorial and state politics. Operating on metaphors of borders and gateways, the Internet infrastructure contradicts claims about openness, connectivity, and democratizing values often ascribed to the Internet.

The undersea cable routes that fiber optic cables take are the most striking example of how the Internet infrastructure maps onto the older route of the telegraph lines. Noting that the "cable network's geography is one of the most static in the history of communications," Starosielski

(2015) explains that cable companies have tended to lay new lines on proven routes, even if these routes are circuitous and historically centered around colonial empires (61). Concerns about national security and high investment costs have hindered cable companies from innovating and diversifying cable routes even as multiple lines are overlaid on the same route for necessary back-up systems. With the cable systems now framed as critical infrastructure in many countries due to their economic, political, and military importance, cable companies are dissuaded from finding new routes along an untested seabed. Internet interruptions due to cable breakage can have severe financial and other repercussions for countries. This has perpetuated, Starosielski (2015) argues, "unequal topographies of global exchange…and a relatively concentrated, semicentralized, and precarious geography" of cable networks (31).

As a result of these persisting colonial topographies, countries in the Global South which did not feature prominently in the telegraph network, continue to have a precarious Internet infrastructure, while former colonial empires which were central to the telegraph networks (Britain, France, and later, America), have more robust contemporary cable networks. Moreover, the mere presence of a cable line passing off a country's territorial waters, or even making landfall in the country does not imply that the country is automatically connected to global Internet infrastructure. In some instances, cable lines connecting two developed centers in the Global North pass right by the shores of a developing country without any spurs connecting it to the country. This remains the case today with Western Sahara – although nearly 7 cable lines skirt just outside of the country's territorial waters, and even make landfall in the Spanish Canary Islands off the coast, none of these cables have spurs to Western Sahara. Similarly, 12 cables pass close to Eritrea without any spurs to the country.

The uneven geography of the cable lines extends to the cable stations,[8] points where an undersea cable does make landfall in a country. Landing stations are one good marker for evaluating the resilience of the Internet architecture in a particular country as multiple landing stations with diverse cable lines passing through these landing stations allows for redundancy so that a line breakage or an issue at one station doesn't affect connectivity in the entire country (Sutherland 2014, 6). For example, in 2012, a ship anchor severed one of the cables landing in Mombasa, Kenya and affected Internet access in six countries in East Africa (BBC News 2012). Mombasa is the only landing station in Kenya, despite the important role that Kenya plays in the East African network. Cable breaks not only affect individual end users in a country but also business corporations and government functionality thus tying cable landing stations and cables to concerns about sovereignty, and national and economic security.

Given this socio-political context, the discrepancies in landing stations is striking. The United States, for example, has 15 cable landing stations on the West Coast alone.[9] This number almost doubles if Alaska and Hawaii are included. It not unusual, however, for developing to make do with far fewer landing stations. The Pacific facing side of South America (containing Colombia, Ecuador, Peru, and Chile) musters up 7 landing stations. India, as I discuss later, does relatively well, with ten landing stations. Almost all major countries in East Africa and West Africa, including Ghana, Nigeria, Kenya, and Tanzania only have one landing station, and the East African landing stations are relatively new ventures built in the last decade[10]. (As I outline later, cable

[8] Landing stations are locations where the undersea cable connects to domestic Internet infrastructure, or which provide power to the cable line so that the signal can continue travelling across continents. They are generally chosen per geographical and political stability as they are a vulnerable node in the submarine infrastructure where cable lines are exposed. These stations are often privately owned by cable companies which may pay any relevant fees to the government.

[9] The statistics on cable stations and cables cited in the rest of the paper are derived from the Telegeography map of submarine cables.

[10] See Sutherland (2014) for a discussion on the undersea cables and landing stations around Africa

companies have only recently discovered countries in the Global South as regions for development – these countries have historically been sidelined in the cable network inherited from the telegraph.)

Countries that lack the built-in redundancy of multiple landing stations and multiple lines, can be drastically affected by breaks in the cable line(s) connecting them to the Internet. The Mombasa incident in 2012 is not an isolated case of regions in the Global South being disproportionately affected by cable breaks.[11] The submarine cables girdling the continent of Africa reveal another form of disparity: some countries appear to have a robust cable infrastructure, but are actually acting as relay stations, as I call them, for cable lines going elsewhere. These relay stations are characterized as locations where a number of cable lines are brought ashore in the country (an apparent sign of a resilient infrastructure), and despite this, the country has relatively low levels of Internet access. Djibouti City, Djibouti illustrates this kind of landing station - although 12 cables come ashore at this station, the country has an internet penetration rate of 18.5% (Internet World Stats 2018). The significance of this cable station in global communications is indicated by the fact that it is a transit point for lines connecting almost 50 countries in Europe, Africa, Asia, the Middle East, and the Pacific. Other countries with such relay landing stations have better Internet penetration but still lack the economic metrics of the developed West: this includes Brazil (where the Fortaleza landing station connects 11 cables in North, Central, and South America), Nigeria (with the Lagos landing station connecting 7 cables in West Africa and Europe), and India (with 10 cable systems making landfall at just the Mumbai landing station).

[11] In April 2018, Mauritania lost Internet access for 48 hours when the only cable connecting Mauritania, Sierra Leone, Liberia, Guinea-Bissau, Guinea, and the Gambia broke due to unknown reasons. All the other affected countries also suffered connectivity issues (Meyer 2018). In 2008, a ship anchor near Alexandria, Egypt, severed two cable lines and disrupted 70% of the Internet network in Egypt, 60% in India, and affected connectivity in 5 other countries, mainly in South Asia and the Middle East (BBC News 2008).

Landing stations like Djibouti City stand out as geopolitical areas or countries with economic markers (like GDP) and Internet access incommensurate with the cable lines passing through them. The locations of these relay stations indicate a continuing pattern of exploitation under neocolonialism as countries in the Global South (some of which are former colonies) enable the connectivity of the developed West even as they remain underdeveloped and lack substantial benefits for their role in the global Internet infrastructure. Although countries like Nigeria, Djibouti, Brazil, and India have been framed as lacking in Internet access in the global imaginary, they cannot be understood solely in terms of this lack. Any discussion of the digital divide, of the dearth of opportunities to citizens and of the failure of the utopian promises of the Internet, has to incorporate the fact that these countries are simultaneously nodes of abundance, enabling the interlinking of the rest of the world. The technical means of improving Internet access in these countries has either already made landfall or passes just off their shores.

Yet, the hypermodern space of the cable landing station, frequently owned by private companies, has been rendered conceptually separate from the territorial state: it exists on state soil but its imprint on the citizens of the state is as transitory as the signals carried in the undersea cables. Whatever money the station yields to the state (via taxation or leasing agreements) or employment opportunities it affords to the local people, even if significant, pale in comparison to the possibilities encoded (and yet unrealized) by cable lines that make landfall only to be routed on to other countries. While national governments might take up the charge of enabling Internet access to their citizens, this charge is not shared by the Tier 1 companies which own this transnational Internet infrastructure.

While the pre-established cable routes, and the precarious infrastructure of cable lines and cable landing stations are all shaped by colonial and neocolonial power relations, patterns of cable

ownership are another significant aspect of this colonial topography of the Internet infrastructure. As I have noted in the earlier section, the telegraph network was mainly built with private capital (with the exception of colonial India), and British, French, and later American companies dominated the landscape with financial investment as well as technical specialization in cable laying and cable repair. This pattern of private ownership of critical communication infrastructure has continued today, and consolidated power in the hands of a small number of American and European companies. While exact rankings have varied over the years, only 13 or 14 private companies or conglomerates control the global gateways to the Internet.[12] The so-called backbone of the Internet comprises of these Tier 1 providers,[13] which operate sprawling independent networks called Autonomous Systems (AS's) and allow other providers access to the Internet via transit agreements. [14]

The scope of these Tier 1 providers and their role in sustaining global communications is unprecedented, and the hegemony of their large AS networks is rooted in the cable lines on which they own capacity. Unsurprisingly, the rankings for these providers are dominated by American and European companies, with only two Asian companies generally ranked in the list: NTT Communications, a subsidiary of the Japanese company, Nippon Telegraph and Telephone Corporation, and Tata Communications, a partnership between the Government of India and the Tata Group. Together, the Tier 1 companies form an influential and exclusive elite club based on mutual recognition and reciprocity. Peering agreements between Tier 1 providers function as gate

[12] For the full list, see the AS Rank Project (2017) by the Center for Applied Internet Data Analysis (CAIDA) or see "A Baker's Dozen, 2016 Edition" by Dyn and the accompanying write up by Zmijewski (2017). This list names Tier 1 providers with *global* networks. Other providers in the Global South are sometimes also considered Tier 1 providers but lack the global capacity of the major networks listed in "A Baker's Dozen."

[13] For more on these Tier 1 ISPs, refer to Mark Winther's white paper "Tier 1 ISPs: What They Are and Why They Are Important" (2006).

[14] Wijeratne (2016) calls Tier 1 networks the "root of Internet connectivity in the world, and explains that a Tier 1 network is "one that [has] access to the entire Internet region solely via its physically established lines or peering agreements without having to pay a third-party provider for said connectivity."

passes to this club, and are based on mutual acknowledgement that the other providers have a global AS network suitably sized to belong to this club. By peering with each other, Tier 1 providers further consolidate their influence in this club, and then require transit agreements from lower tier providers (which constitute their customer base). Networking between all ISP's (including the Tier 1 networks) is then configured via the Border Gateway Protocol (BGP), which charts an optimal route for Internet traffic between various AS's.

Peering, transit, and BGP are commonly deployed technical concepts and their application isn't limited to Tier I companies. Yet, in the context of the Tier I providers, they operate as protocols of territoriality, borders, and control over mobility, and evoke virtual empires which have carved out their own territories. These territories don't operate on open borders; rather agreements based on influence and monetary exchange define which AS's connect and how they connect to each other. In the postcolonial context that I have sketched out so far, these Tier 1 companies, their concentrated ownership in the Global North, and their socio-technical protocols of operation indicate an ideological outlook entrenched in the asymmetrical power relations of the physical world. The slippage of metaphors between the real and virtual worlds, particularly in relation to borders, mobility, and territories, highlights the complex manner in which the geopolitical issues confronting postcolonial states under neocolonialism become mapped onto (and play out) in the virtual empires of the Tier 1 companies.

Decolonizing the undersea Internet infrastructure

While the global telecom scene I have sketched appears bleak, it is not an ossified or immutable structure. In the remainder of this article I focus on the transnational decolonial work that can be undertaken by public-private partnerships to reshape the colonial topography of the

Internet infrastructure in the Global South, offering Tata Communications and the SEACOM cable line as examples. Tata's entry into the exclusive Tier 1 group, as the sole company from the Global South, is often described in tech circles as a matter of luck and happenstance starting with the cable market crash of the 1990s which busted major actors and created a space for new entrants. This story of luck, however, underplays the socialist vision and planning undertaken by the Government of India for years before the cable crash. The company now known as Tata Communications began in 1986 as a government owned company called Videsh Sanchar Nigam Limited (VSNL). Under government ownership, VSNL brought public Internet service to India in 1995 before the government divested part of its shares in 2002 to the Tata Group. The newly named Tata Communications has built on the infrastructure and investment the government had in VSNL.

Without glossing over the hegemonic emplacement of Tier 1 providers, or uncritically embracing the capitalist business model on which Tata Communications (and other Indian telecom companies like Reliance) operate, I would like to emphasize the significance of Tata Communications as the only global Tier 1 company in the Global South. Globally, the Tata Communications network today sustains 25% of the world's internet routes and the company's holdings include the largest "wholly owned" fiber network (Tata Communications – About 2018). Tata has built or invested in cable lines (such as SEACOM and the SEA-ME-WE 4) between South Asia and East Africa and in other regions overlooked by other cable conglomerates. And when the company completed its global fiber ring (TGN-EA) in 2012, it offered more "city-to-city connections," a departure from the "more traditional networks which only link cable landing stations" (TATA Press Release 2012). This new mode of operations offers more flexibility for connecting cities in the Global South to the Internet.

Just as TATA's lines have recognized hitherto underconnected countries, the SEACOM line connecting East Africa, South Asia, and the Middle East represents another shift in the cable landscape. Aside from introducing a major cable line between the underserved regions of East and West Africa, this line was built with 75% African investment (Sutherland). While the cable network was historically oriented around colonial power centers, and tacitly favored communication from the Global North to the Global South, cable lines like SEACOM are reorienting South-South communication pathways. Notably, the SEACOM line isn't tied to just one country: by creating knowledge and communication pathways between postcolonial states, this cable project envisions a linked future of regional co-development and co-operation.

Such initiatives, which are better attuned to local and regional needs, and the changes in historical patterns of ownership and investment are slowly decentering the Internet infrastructure and enabling Internet access in countries which were perceived as unprofitable and hence underserved by the cable industry. The impact of these new developments has been visible in the rankings of Tier 1 companies, with traditional telecom companies that had not envisioned the demand for Internet connectivity in the Global South languishing behind. One list of top Tier 1 companies showed U.S. companies like Verizon and Sprint languishing at the bottom of the list, and led Zmijewski (2017), the writer contextualizing the list, to conclude that "traditional US carriers continue to fade from view, while providers more focused on emerging markets continue to climb in our rankings." That these languishing carriers have now "renewed focus on emerging markets" and suddenly discovered new regions in the Global South indicates a key problem of entrusting the Internet infrastructure to private capital operating on an already flawed telegraph undersea network: asymmetrical infrastructural development following a perception of insufficient technological demand or need in the Global South.

Framed in the intertwining colonial and capitalist registers of technological backwardness and hence lacking in the demand for Internet technologies which private capital could then supply at a price, countries like India have instead been the focus of Western technological *aid*, in the form of schemes like One Laptop Per Child in the 2000s, and Facebook's Free Basics in 2015. While both schemes were rejected in India, they were implemented in other parts of the Global South. Most recently, Google has championed Project Loon, to deploy high altitude satellite balloons in remote and rural areas to create a wireless Internet network despite the known problems with satellite Internet. Although the project derives its name from the balloons which are expected to provide satellite communications, I am more struck that this name also denotes something that even the company terms as loony.

These aid initiatives are rendered even more disingenuous as firms like Google, Facebook, (and Microsoft) have started investing in their own cable lines as part of business development, even as they push experimental and limited programs like Free Basics and Project Loon in the Global South as part of their humanitarian commitment. The cable lines which may eventually pass along the shores of Global South companies carry far more potential for connecting these countries to the Internet, and yet, they are not framed within the humanitarian commitment of these multinational corporations. The alarming example of the British East India Company developing a telegraph infrastructure in colonial India for the purported benefit of the Indian peoples while using it to advance its own interests is ultimately illustrative in reading these contemporary accounts of private companies investing in the submarine cable lines. The disparities in cable routes, cable lines, landing stations, and cable ownership that I have traced here indicate both, a continuation of colonial communication networks and a perpetuation of these inequities under capitalist development of Internet infrastructure.

This vexed history forms the unstated and unreckoned with context for the Digital India program (and other programs to redress the digital divide) as well as the UN declaration on Internet access with which I began this article, and raises troubling questions about the ownership of the Internet infrastructure, and government programs targeting historical inequities in telecommunication networks. It is difficult to reconcile the notion of the Internet as a core utility to citizens (as Digital India proposes) or as fundamental to human rights (as the UN posits), with the Internet infrastructure owned by companies accountable to private interests, shareholders, or linked to countries in the Global North. Given the kind of power and influence the Tier 1 providers hold on the global telecommunication scene, we must interrogate the accountability and commitment that these providers hold in improving Internet access or upholding human rights while continuing to work on decolonial projects to shift the inherited colonial topography of the Internet infrastructure.

References

Ali, Syed Mustafa. 2016. "A brief introduction to decolonial computing." *XRDS: Crossroads*. 22 (4):16-21. doi: 10.1145/2930886

Anderson, Benedict. 1985. *Imagined communities: reflections on the origin and spread of nationalism*. London: Verso, Print.

Ball, James, Luke Harding, and Juliette Garside. 2013. "BT and Vodafone among telecoms

companies passing details to GCHQ." *The Guardian*. August 2.

Baran, Paul. 1964. "On Distributed Communications: 1. Introduction to Distributed Communications Networks." *The RAND Corporation*. Web.

BBC News. 2008. "Severed cables disrupt internet." *BBC News*. January 31.

Center for Applied Internet Data Analysis. 2018. "AS Rank Project." CAIDA. 2017. Web. 20 June.

Choudhury, Deep K. L. 2010. *Telegraphic Imperialism: Crisis and Panic in the Indian Empire C.1830-1920*. London: Palgrave Macmillan. Print.

Choudhury, Deep K.L. 2003. "India's First Virtual Community and the Telegraph General Strike of 1908. *International Review of Social History*. 48 (s11): 45-71. doi: 10.1017/S0020859003001263

Department of Telecommunications. 1994. "National Telecom Policy, 1994."

Ministry of Electronics and Information Technology. 2018. "Vision of Digital India." Web.

Gallagher, Sean. 2013. "Telegram not Dead. Stop." *Ars Technica*. June 19.

Goldsmid, Frederic John. 1874. *Telegraph and Travel*. London: MacMillan. Print.

Gopika G G. 2014. "Growth and Development of Telecom Sector in India – An Overview." *IOSR Journal of Business and Management*. 16 (9): 25-36. doi: 10.9790/487X-16912536

Gurumurthy, Anita, Nandini Chami, and Sanjana Thomas. 2016. "Unpacking Digital India: A Feminist Commentary on Policy Agendas in the Digital Moment. *Journal of Information Policy*. 2: 371-402. doi: 10.5325/jinfopoli.6.2016.0371

Gorman, Mel. 1971. "Sir William O'Shaughnessy, Lord Dalhousie, and the Establishment of the Telegraph System in India." *Technology and Culture*. 12 (4): 581-601.

Harding, Sandra. 2009. "Postcolonial and feminist philosophies of science and technology: convergences and dissonances." *Postcolonial Studies*. 12 (4): 401-421. doi: 10.1080/13688790903350658

Headrick, Daniel. 1991. *The Invisible Weapon: Telecommunications and International Politics, 1851-1945*. Oxford: Oxford UP. Print.

Hopkins, Curt. 2012. "Ship's anchor cuts Internet access to six East African countries." *The Christian Science Monitor*. February 29.

Hunter, William Wilson. 1890. *Rulers of India: The Marquess of Dalhousie*. London: Clarendon

Press. Print.

Hunt, Bruce. 1998. “Insulation for an Empire: Gutta-Percha and the Development of Electrical Measurement in Victorian Britain,” in *Semaphores to Short Waves*, edited by Frank James. London: Royal Society of Arts. Print.

Mattern, Shannon. 2018. “Scaffolding, Hard and Soft: Critical and Generative Infrastructure.” In *The Routledge Companion to Media Studies and Digital Humanities*, edited by Jentery Sayers. New York: Routledge. Print.

Meyer, David. 2018. “An Entire Country’s Internet Was Cut Off for 2 days After an Underwater Cable Broke.” *Fortune*. April 9.

Nakamura, Lisa. 2001. *Cybertypes: race, ethnicity, and identity on the Internet*. New York: Routledge. Print.

Naughton, John. 2016. “The evolution of the Internet: from military experiment to General Purpose Technology.” *Journal of Cyber Policy*. 1 (1): 5-28. Web. doi: 10.1080/23738871.2016.1157619

Navarria, Giovanni. 2016. “How the Internet was born: The network begins to take shape.” *The Conversation*. October 30.

Risam, Roopika. 2018. Decolonizing the Digital Humanities in Theory and Practice. *The Routledge Companion to Media Studies and Digital Humanities*. Ed. Jentery Sayers. New York: Routledge. Print.

Sneha, P.P. *Mapping Digital Humanities in India*. CIS Papers, 2016.

Standage, Tom. 2014. *The Victorian Internet: The Remarkable Story of the Telegraph and the Nineteenth Century's Online Pioneers*. New York, NY: Bloomsbury. Print.

Starosielski, Nicole. 2015. *The Undersea Network*. Durham: Duke UP. Print.

Steiner, Peter. 1993. “On the Internet, nobody knows you’re a dog.” *The New Yorker*. July 5.

Sridhar, Varadhrajan. 2012. *The Telecom Revolution in India: Technology, Regulation, and Policy*. Oxford: Oxford UP. Print.

Sutherland, Ewan. 2014. “Undersea cables and landing stations around Africa: Policy and regulatory issues.” *25th European Regional Conference of the International Telecommunications Society*. Brussels, Belgium.

Tata Communications. “About.” *Tata Communications*. Accessed on 20 June 2018.

Tata Communications. 2012. “Tata Communications completes world’s first wholly owned cable

network ring around the world." March 22.

Telecom Regulatory Authority of India. "Acts and Policies." *TRAI*. Accessed on 20 June 2018.

Telecommunications Reform in India. Ed. Rafiq Dossani. Westport: Quorum Books, 2002. Print.

TeleGeography. 2018. "Submarine Cable Map." *TeleGeography*. Updated June 28. Web.

Thomas P.N. 2012. Digital India: *Understanding Information, Communication and Social Change*. New Delhi: Sage. Print.

Tully, John. 2009. "A Victorian Ecological Disaster: Imperialism, the Telegraph, and Gutta Percha." *Journal of World History*, 20 (4): 559-579. Print. doi: 10.1353/jwh.0.0088

United Nations General Assembly, Human Rights Council. The promotion, protection and enjoyment of human rights on the Internet, A/HRC/32/L.20 (27 June 2016).

Wijeratne, Yudhanjaya. 2016. "The Seven Companies That Really Own The Internet." *icaruswept*. June 28.

Winther, Mark. 2006. "Tier 1 ISPs: What They Are and Why They Are Important." Sponsored by NTT Communications. May 2006.

Zmijewski, Earl. 2017. "A Baker's Dozen, 2016 Edition." Oracle + Dyn. Feb 15.