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# Data Centres between North-South and East-West

## Brett Neilson

As recently as 2014, *The Hindu* reported that India was unlikely to emerge as a global data centre hub. Citing factors such as outdated telecom policies and rolling power cuts, the newspaper noted that smaller rivals such as Singapore, Hong Kong and Taiwan had outperformed India in this key sector of the digital economy (Charlie 2014). Five years later, an industry report by consultancy firm Broad Group (2019) indicated that India is the world’s second largest market for data centre infrastructure and the second fastest growing data centre market in Asia, after China. According to this report, seventy percent of India’s data is still stored beyond its shores but new data localisation legislation means that growth will proceed rapidly, particularly in cities such as Mumbai, Chennai, Hyderabad and Bengaluru. The significance of the Broad Group report lies less in its boosterism, which serves the data centre industry’s search for new frontiers, than its registration of the changing global geography of data centre location. One of the most important contributions of the essays that make up this volume, which examine the history and present of data centres in India, is to take stock of this changing geography. Existing critical work on these facilities tends to focus on infrastructures located in the global North (see, for instance, Hogan and Vonderau 2019). By giving due attention to the conditions of emergence and operations of data centres in one of the world’s most important rising markets for these infrastructures, the essays in this book begin to ask how data centres contribute to the production of geographical and economic conditions that shift the axes of global power. In this way, the volume adapts the argument

that ‘postcolonial capitalism’ is a global condition (Mitra, Samaddar and Sen 2017) to the new modes of governance made possible by digital technologies.

Allow me to dwell briefly on my use of the term global North. The contrast between the global North and global South provides a means of identifying economic inequality between wealthy and impoverished world regions. The distinction has its origins in narratives of social modernisation and economic development that arose (and acquired an increasingly technocratic elaboration) in the wake of World War II (Brandt Commission 1980). Along with the East-West civilizational divide, which is a relic of Eurocentric spatial and cultural constructions, this split has structured many systematic approaches to world history and commerce. The title of this essay seeks to draw attention to the ways in which the social, economic and technical networks generated by data centres trouble these divisions, which have never corresponded to definitive geographical representations. A rigorous approach to the mutations of governance and power effected by data centre operations, I suggest, must account for material changes in the constitution of global space. Particularly when dealing with data centres in India, there is a need to interrogate how their tendency to establish weak social, as opposed to infrastructural, ties to their surrounding urban and national contexts intersects their positioning within territorial and geopolitical arrangements predicated on international and regional competition.

This interruption of North-South economic divisions and East-West civilizational binaries by data centre operations is only part of the story I want to tell. The terms North-South and East-West also have a precise meaning in data centre technical jargon, where they describe different patterns of networking and traffic. North-South traffic is the movement of data between servers inside a data centre and external client machines that connect with them, usually by mediation of a so-called access layer that controls which servers within a facility interact with any given client. East-West traffic, by contrast, is the passage of data between

servers in the same facility, whether they are physical machines wired together by cables or virtual machines reassigned across different physical machines by data centre infrastructure management software. As the data centre business has expanded and these infrastructures have come to house servers run by many different commercial and governmental organisations, East-West traffic has become more intense than North-South traffic. This is because a query sent to a data centre by any single client machine triggers multiple interactions between servers to generate a response. Such arrangements are important for today's extractive data economies, enabling a situation where multiple parties benefit by accumulating data from client interactions. The question arises as to how these movements along the North-South and East-West axes of data centre traffic relate to the use of the terms North-South and East-West as indicators of economic and civilizational difference. Without proposing a simple alignment between these different invocations of the compass points, I suggest that the chapters that comprise this book provide a privileged perspective from which to grapple with this question.

**What is a data centre?**

Before tackling the issue of how data centre traffic intersects the changing global arrangement of economy, politics and territory, it is necessary to establish some basic knowledge for understanding the growing significance of data centres. In the twenty-first century, data is at the edge of strategies of economic expansion. The business model by which internet users contribute data to tech companies by using social media and other digital platforms is central to this expansion, although by no means the only method of extraction at work in the contemporary data economy. High frequency trading in financial markets, smart city initiatives, employee and workplace monitoring, health tracking, quantified-self applications, border control, government services, logistics industries, and political campaigning—these are just some of the areas in which the collection and analysis of data

have become increasingly prominent in recent years. Indeed, data is becoming integral to everyday social relations, making the ways in which it changes the social order increasingly difficult to distinguish from other ongoing transformations. Data centres provide the key infrastructural facilities for such changes, assembling servers under a single roof so that the organisations that place them there can take advantage of economies of scale and peering relations that offer competitive advantages. Although there are many different types of data centre, a minimal definition would recognise this collocation of servers for purposes of storage, transmission and processing of data. Generating computational capacities that exceed those of servers housed at a distance from each other, data centres present a physical shell designed to host an ever-changing set of contents. In this sense, as Jesse LeCavalier (2016: 96) writes, a 'data center is not a building full of computers but rather a computer with architectural qualities'.

As Ritayoti Bandyopadhyay writes in his contribution to this volume, the contemporary data centre is 'the key logistical installation that converts data into capital and governs the contemporary data economy'. In order to effect this conversion of data into capital, data centres must supply technologies that provide opportunities for the extraction and aggregation of data. Their capacity to generate value and further regimes of accumulation rests on two main capabilities. The first is the possibility to extract data at little or no cost, as occurs in the case of social media platforms whose users agree to contribute data without payment in exchange for the provision of services. The second is the ability to aggregate data collected from various sources into so-called big data sets that offer opportunities for analysis with market relevance. Together, these techniques, which can involve various combinations of software, hardware and human expertise, facilitate the expansion of one of contemporary capital's primary frontiers for the extraction and accumulation of value. Who the beneficiaries and victims of these processes are rests on contractual and technical relations

among the organisations present in the data centre—relations that take on diverse forms depending on patterns of ownership, networking and legal obligation.

A state of the art data centre, such as the Ctrl-S facility investigated by Manish Jha and Rishi Jha in their study of data centres in Navi Mumbai, is a multi-user facility that allows different organisations to place or hire servers in a single installation. In such a situation, the wiring together of machines allows privileged forms of peering by which organisations connect directly with each other to exchange data rather than having to establish links through the slower public internet. However, many data centres are single-user or 'captive' facilities, such as the one run by the West Bengal State Electricity Distribution Corporation discussed in Ritam Sengupta's contribution to this book. As Sengupta argues, even captive facilities, which generally house servers run by a single organisation, tend toward more 'open' architectures—a feature that has accompanied the shift of state run data collection enterprises to a public-private partnership model. The large data centres run by companies such as Amazon and Google, for instance, are single-user facilities, but the machines they house host services and applications, including public cloud services, which many different users avail (either on a paid basis or freely in exchange for allowing these organisations to extract data generated by their activities). To this single/multi-user typology of data centres, it is possible to add other kinds of classification. The evolution of edge computing, for instance, brings a new kind of data centre that operates in physical proximity to users or internet-of-things devices to provide fast response times and/or filter data for processing back to a central facility. The tiered system of data centre ratings is another relevant classification that categorises installations according to industry-set standards related to floor space, computing capacity, uptime, power usage, environmental efficiency, and so on.

Apart from the cables that link servers in data centres to client machines that operate at a distance from these facilities, the pattern of wiring that links servers to each other in these

installations is a crucial element of their design. These so-called network topologies are variable and purpose suited. With names like closed-tree, fat-tree, Clos, BCube, c-Through, Helios and Hedera, they imply different trade-offs between network qualities such as speed, redundancy, path diversity, energy conservation and scalability. A data centre that attracts business from high-frequency financial traders, for instance, is likely to have a Clos topology, since this architecture reduces buffering and favours low latency transmission that provides information from stock markets with minimal delay. By contrast, a large commercial multi-user centre might prefer a fat-tree topology that modularises the servers used by different firms and connects them to each other via electronic switches that lead to a "meet"-me (peering) room. When such a centre supplies software, platforms or infrastructure as a service, however, a more flexible architecture that utilises optical switches to reconfigure during runtime is an attractive option (Liu et al. 2013).

It is important to remember that data centres require certain preconditions of land and water that link them back to the basics of agrarian political economy. The energy usage of these facilities has been a preoccupation of environmentally minded media scholars who seek to debunk the myth of a clean digital economy (see, for instance, Carruth 2014 and Hogan 2015). Large multi-user installations keep diesel turbines idling over so they can kick into action if mains power fails. Like the 'dark satanic mills' that William Blake associated with the factories of the early industrial revolution, these facilities require fossil fuels. Yet, despite these continuities with earlier forms of agrarian and industrial activity, the data economy presents a novel scale of operation that intensifies and multiplies the extractive capacities of digital technologies, allowing the extraction of not merely raw materials or alienated labour but patterns of social cooperation that generate data that can be stored, analyzed and sold. In temporal terms, this production of data as a commodity involves a massive reduction of turnover time with respect to earlier forms of commodity production and circulation, meaning

that data centres enjoy a long lifespan as fixed capital with respect to the number of turnovers they support. In spatial terms, the data centre presents a kind of fix due to its capacity to centralise extractive operations in a single site and attract data transactions across wide (potentially planetary) geographical vistas. This technical capability of data centres makes their location particularly apposite, as the economic advantage that accrues to parties with servers in these facilities derives from human inputs to client machines that may be located at vast distance. Data centres thus acquire a geopolitical significance as they concentrate relations of capital and labour that unfold over wide expanses into a dense congregation of servers, switches and wires. They are not only technical facilities but also political institutions that influence the wielding of power across diverse geographical scales. Considering how data centre North-South and East-West traffic crosses the North-South and East-West axes of world power thus becomes a crucial task of political and economic analysis.

**Where do data centres come from?**

As the contribution of Ritayoti Bandyopadhyay shows, data centres do not come out of nowhere but evolve in complex ways from former computing facilities as well as path dependent patterns of cables and satellite technologies. Bandyopadhyay's history of computing in India and the role of the Indian Statistical Institute in amassing and managing large corpuses of data emphasises the deployment of these technologies for purposes of governance and population management. His account, in other words, raises the political significance of data centres as well as their economic role—a theme that, as we shall see, needs to encompass questions of sovereignty as well as governance. In any case, the emergence of the data centre from the mainframe computing room of the 1950s and 60s is a process that crosses the personal computing revolution of the 1980s and the rise of the internet as mass medium in the 1990s. Many industry commentators draw a parallel between

the arrival of edge computing and the process of decentralisation that accompanied the diffusion of the personal computer in the 1980s. They note similarities between virtualisation in cloud computing and mainframe time-sharing technologies (Nemani 2011) and posit a cyclical movement between centralisation and decentralisation in the history of computing. Bandyopadhyay shows that the picture is more complicated than this and must take into account wider transformations such as the intersection of state governance with profit-making activities. The entanglement of data centres with historical forces becomes even more obvious if we attribute to them multiple genealogies, adding to their predecessor institutions facilities such as cable stations and warehouses.

The data centre in many ways has replaced the cable station as the crucial switch point for communication signals. Due to point of presence technology, which allows the streaming of signal traffic into data centres, the cable station has become merely a site of power supply for the undersea cables that transmit digital information around the world. Nonetheless, the geography of the telegraph cables laid by imperial state powers in collaboration with private interests in the late nineteenth century has established patterns of path dependence that remain important for today's data economy. Not accidentally have cities such as Singapore and Hong Kong, which were early points of telegraph cable connection, emerged as data centre hubs in the early twenty-first century. We can argue about the changing forms of power and different kinds of space-time compression enabled by the telegraph as opposed to the internet and other contemporary networks of data transfer. Nicole Starosielski takes up these issues in her book *The Undersea Network* (2015). However, the entanglement of these technologies with forms of imperial power and the mutation of these forms of power in the postcolonial era remains an important thread to follow in accounting for the political role of data centres. Such matters are particularly pressing when it comes to understanding the relevance of North-South data centre traffic, which has generally moved data from the global

South to the global North, with respect to the East-West traffic that is instrumental to the extractive capabilities of the contemporary data centre. That point of presence technology mediates the connection between servers in a data centre and the cables that transmit information to and from client machines means that those aspects of data centre operations that derive from the cable station play a key role in setting its logistical position as a site of control and extraction.

The entanglement of data centres with imperial power also becomes evident if we consider their affinities with the warehouse, another kind of facility important to their genealogy. At the level of architectural morphology, data centres bear a resemblance to the factories or *feitorias* established by European imperial powers around the globe during the early modern period. These fortified structures were *entrepôts* or fledgling free trade zones where local inhabitants interacted with foreign merchants. They acted simultaneously as marketplaces, storage houses, garrisons, and headquarters for the kinds of de facto government established by chartered companies. Importantly, they also functioned as footholds for making wider territorial claims, which played out in various ways with the twists and turns of colonial history. Factories thus played a role in the shift toward the formal kinds of imperial government that would emerge in the nineteenth century. With the establishment of formal colonial territories, they mutated into warehouses, which played a largely logistical role in the organisation of trade. The nineteenth century warehouse was not only a site of an obvious division of labour but also a facility for procurement, sale and negotiation. Across the course of the twentieth century, but particularly with the so-called logistics revolution that followed World War II, these functions moved elsewhere in the logistical chain, and the warehouse became an increasingly automated environment. Today data centres perform a warehousing function for a new kind of immaterial commodity, which requires material infrastructural support. That many data centres occupy old industrial warehouses is no accident. Likewise,

the role of data centres in coordinating the labour of moving physical commodities in warehouses is a feature of today's logistical world (and part of the business model of organisations such as Amazon, Alibaba and Flipkart). The warehouse is thus a double of the data centre, both its ghostly ancestor and commercial twin.

Doubtless, it is possible to locate other kinds of social institutions and infrastructures that provide genealogical background for the data centre. The dream of the total archive continues to haunt these facilities, placing them in line with libraries, museums, and other collecting institutions. Despite the rapid turnover of storage media in computing (from punch cards to floppy disks and USB sticks), the fantasy of sucking up as much data as possible and making it accessible in readable form animates the contemporary data centre. As Jacques Derrida (1996) teaches, however, the archive is always partial. The contemporary data centre breaks with theory and practice based on organisational and governmental records to recast the archive as a storage site for diffuse and often dissociated data, including that posted to social media sites by users or that collected by sensors monitoring all kinds of physical movements and transformations. Data analysis promises to create value from this excess, which can theoretically be gathered from anywhere in the world. No longer linked to the statistical imperatives of national governance, data centres cast a territorial net beyond the borders of their containing states, connecting and linking client machines distributed across different global sites. Although so-called data sovereignty or localisation legislation attempts to restrict this distribution by requiring the storage of certain kinds of data on national territory, the role of data centres in creating new kinds of territory, much like the colonial factories of early modern times, needs to be taken seriously. Talk of 'data colonialism' (Couldry and Mejias 2019) needs to be supplemented with understanding of the role of North-South and East-West traffic in facilitating the extractive economy of data centres. That India is emerging as a data centre location and market signals that these patterns of data colonialism do not necessary

follow those of modern imperialism or abide the analytical markers of global North and global South. Tracking these patterns requires technical knowledge as well as an analytical handle on the changing operations of capital in a postcolonial world.

Manish Jha and Rishi Jha's study of how data centres evolve in the changing urban form and political economic environment of Navi Mumbai offers such an analysis. Importantly, their chapter links the presence of data centres to the emergence of a new labour territory and labour subjectivity in a situation where 'data is more important than any employee'. At stake is a workplace that is hierarchical, segmented and surveilled. Characterised by various kinds of human-machine interface and an imperative to avoid faults and downtime, which are predictable in a system designed for resilience and redundancy, the labour regime combines a need for high tech knowledge with extreme precarity. The data centre, however, is a relatively labour free zone, staffed mostly by male managers, technicians and security personnel. It is at the client end of the North-South traffic relation that labour is most evident, regardless of how it is organised, located or remunerated (or in the case of users of social media or other digital platforms not remunerated). The flashing lights and humming fans of the data centre, in other words, register the presence of distant labour forces, which are connected and organised into patterns of social cooperation by the network topologies that structure the flow of North-South and East-West traffic. If the way in which data centres convert data into capital seems magical or instantaneous, it is important to remember that the real engine of these developments is the living knowledge, intelligence and subjectivity located at the client end of the North-South relation. To understand the significance of India's emergence as a data centre market, it is thus necessary to track the diverse and multiple locations in which labour forces and subjects generate the data that the country's facilities store, process and transmit. Researching these relations and flows is a challenging task not only because of their multiplicity and extent but also due to matters of commercial

confidence and technical black boxing. Nonetheless, a diagram displaying these associations and interactions would be an important tool for understanding how digital techniques and technologies change India's geopolitical position in the world system.

**What do data centres do?**

Storage, processing and transmission of data are the typical functions assigned to the data centre. In his chapter on the West Bengal State Electricity Distribution Corporation (WBSEDC) data centre, Ritam Sengupta shows how these functions combine into what he calls modulatory forms of governance and control. Focusing on how the feedback of data concerning 'loss' (primarily the unmetered use of power in the electricity grid but also financial and information loss) is constitutive for the operations of the data centre under question, Sengupta argues that the facility provides an important hinge between digitalised control and more traditional forms of bureaucratic organisation. The automated fault monitoring system that logs incidents of loss, for instance, requires manual acknowledgement by an operator before the system makes adjustments. Such a sequencing of action, however, is not bureaucratically neutral, because digital control mandates a reorganisation of administrative powers within WBSEDC. Sengupta shows how the cybernetic logic of data centre operations intersects other economic and political contingencies associated with the mutations of postcolonial capitalism and the workings of the Indian state. These transformations kick each other on, making the data centre a key institution through which to track the relation between digitally inflected forms of power and wider shifts in the political economic constitution of the postcolonial world.

Although these relations, in Sengupta's account, are specific to the 'captive' or single-user data centre, they are by no means restricted to such installations. It is worth asking how the logics of postcolonial capitalism and the shifting valences of state governance influence the

operations of a top tier data centre such as the Ctrl-S facility discussed by Manish Jha and Rishi Jha. Is such a facility, with its multiple clients and complex systems of redundancy and resilience, simply a transplant of a state-of-the-art data centre on to Indian territory? Jha and Jha answer this question in the negative by describing two parallel processes. First is the Indianisation of data centres or the location of these facilities on Indian soil in order to serve Indian clients. Second is practices of 'extrastatecraft' (Easterling 2014) that work in parallel, partnership and rivalry with the state to facilitate the insertion of these infrastructures into global networks of capital. On the hand, data centres perpetuate modes of governance that draw on the experience of the postcolonial Indian state in dealing with populations, security, welfare, territorial management, and so forth. On the other hand, these installations have weak social ties with their surrounding environments and take root in a kind of urban form designed for purposes of logistics, finance and extraction. The result is the emergence of privately run facilities that are state dependent. Data centres become crucial switch points between the governmentalisation of the state and the insertion of the state into wider networks of governance in which capital itself is the key political actor. They are sites of 'multiple, overlapping or nested forms of sovereignty' in which domestic and transnational infrastructure spaces patch together.

The technical form of this patching is peering or the establishment of privileged connections between servers within data centres. At once facilitating exchange between local/national enterprises invested in a data centre and their connection to global informatics and technical giants that maintain point of presence in an installation, peering is the central business proposition of a multi-user centre. The centrality of peering to data centre operations is the main reason that East-West traffic between servers in a facility has begun to outweigh North-South traffic between servers in a data centre and external client machines. I have already discussed how a single North-South query can generate multiple East-West interactions and

how this technical arrangement supports an extractive data economy by which multiple parties can accumulate data from a single source. However, it is also necessary to ask what purposes such data accumulation serves. Certainly, the selling of such data (or of information generated by its analysis) is a strong commercial motive. More importantly, machine learning and other artificial intelligence routines can train on such data to create new products and services, whose development sits on the edge of contemporary economic development and geopolitical rivalries (witness the current 'tech war' between the USA and China). Ownership of data thus becomes crucial to the digitalisation of the economy as it provides the commercial and technical basis for the development of artificial intelligence applications that are central to both current regimes of capital accumulation and projects of algorithmic governance.

The storage of data in a facility located in a certain national territory, however, does not equate to ownership of such data. This is one reason why data localisation laws requiring the storage of certain classes of data on national territory do not entirely address the issue of data extraction by global tech firms. If the presence of the Great Firewall around the Chinese internet and the inaccessibility of the Chinese internet market to foreign firms has occasioned wide debate in relation to democracy and freedom, it also means that Chinese tech firms have been able to accumulate vast amounts of data from which they are now able to develop artificial intelligence applications. India sits in a different relation to such data holdings. Although the Aadhaar personal identification number and the parallel development of the India Stack are responses to this predicament, India's capacity to rival China as a developer of artificial intelligence applications is limited. All of which goes to show that patterns of North-South and East-West data traffic do not necessarily follow North-South and East-West divisions of global power. Given the vastness of its population, India can become data rich quickly. Doubtless, then, the development of data centres in India will not float freely from

state issues of governance and population management and the model of privately run facilities with state dependencies will continue for some time.

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