Platform and Stack, Model and Machine

The goal of future wars is already established: control over the network and the flows of information running through its architecture. It seems to me that the quest for global totalitarian power is not behind us but is a true promise of the future. If the network architecture culminates in one global building then there must be one power that controls it. The central political question of our time is the nature of this future power.

—Boris Groys[1]

The essence of datagram is connectionless. That means you have no relationship established between sender and receiver. Things just go separately, one by one, like photons.

—Louis Pouzin[2]

9. Platforms

Platforms are what platforms do. They pull things together into temporary higher-order aggregations and, in principle, add value both to what is brought into the platform and to the platform itself. They can be a physical technical apparatus or an alphanumeric system; they can be software or hardware, or various combinations. As of now, there are some organizational and technical theories of platforms available, but considering the ubiquity of platforms and their power in our lives, they are not nearly robust enough. Perhaps one reason for the lack of sufficient theories about them is that platforms are simultaneously organizational forms that are highly technical, and technical forms that provide extraordinary organizational complexity to emerge, and so as hybrids they are not well suited to conventional research programs. As organizations, they can also take on a powerful institutional role, solidifying economies and cultures in their image over time. For The Stack, this is their most important characteristic but perhaps also the hardest to fully appreciate. Platforms possess an institutional logic that is not reducible to those of states or markets or machines, as we normally think of them. They are a different but possibly equally powerful and important form. Many different kinds of systems can be understood as

platforms, from urban street grids to Google, and so to consider their common operations, some abstraction is necessary. Part of their alterity to normal public and private operations is the apparently paradoxical way that they standardize and consolidate the terms of transaction through decentralized and undetermined interactions. Platforms can be based on the global distribution of *Interfaces* and *Users,* and in this, platforms resemble markets. At the same time, their programmed coordination of that distribution reinforces their governance of the interactions that are exchanged and capitalized through them, and for this, platforms resemble states. Platforms are often based on a physical standardization of functional components that allows for more diverse and unpredictable combinations within a given domain. On the macro scale, the intermixing of public-facing infrastructural investment and oversight tied up with the privatization of existing public services makes the political identity of platforms that much more ambiguous.[3] So long as those exchanges are regularized by passage through the platform's established forms, they enforce the optimization of interactions by binding open exchanges between self-directed *Users* at the edges of its network. When those forms are computational (as for Google), that passage is the capitalized translation of interactions into data and data into interactions, and the movement of these into and out of central locations (such as strongly defended data centers). As we will see, the genealogy of platforms is diverse and seemingly contradictory. Roman urban planners, the encyclopedia of John Wilkins, Charles Babbage, the Commissioners' Grid Plan of 1811, John Maynard Keynes, Friedrich Hayek, Lady Ada Byron, Vint Cerf, and others, all contribute to the parentage of platforms, and it is their eccentricity and exteriority from normal state and market institutional models, combining elements of these as well as of machine engineering, that has made them so successful in redrawing the effective terms of global systems.

Platforms demand an active conversion between economic and technical systems and their respective limitations. Their initial program may be born of economics, but their execution can push sideways through other models of value, confounding and compressing the political spectrum along with them. Their history bears this out. A working technical definition of *platform*, in general, may include references to *a standards-based technical-economic system that simultaneously distributes interfaces through their remote coordination and centralizes their integrated control through that same coordination.*[4] I will unpack this definition below. What I call platform logics refers first to the abstracted systems logic of platforms (their diagrammatics, economics, geography, and epistemology of transaction) and second to the tendency on the part of some systems and social processes to transform themselves according to the needs of the platforms that might serve and support them, both in advance of their participation with that platform and as a result of that participation. Platforms provide an armature and induce processes to conform to it. The Stack is a platform, or, more accurately, a combination of platforms. Its own governing logics are derived from platform logics,

but its geography and geometry are also peculiar, and so while stacks are platforms, not all platforms are stacks, and in fact most platforms are not stacks.

While systems that arguably operate as platforms might be found in every culture, where does the concept of platform come from, specifically in relation to the development of modern machines? The etymology of *platform* refers to a "plan of action, scheme, design" and, from the Middle French, *platte form,* or, literally, a plateau or raised level surface. As Benedict Singleton writes, this conjoined with the *plot*, which itself first implies a plot of land. Once situated on the platform of the stage, the "plot" becomes a more abstract structure that situates characters into the forgone conclusion of its unfolding, even as they suffer the choices that aren't really theirs to make. As Singleton would have it, here the plot is a diagram that *ensnares* the *Users* of the platform in its designs.[5] By at least 1803, *platform* takes on more explicitly political meaning, as in a "statement of party policies." All three of these connotations (platform as a plan of action, as a stage for a plot, and as proposed rules governance) are important for understanding The Stack as a platform and for platform sovereignty in general. One is set of instructions, one is a situated place where action is played out according to plan, and one is a framework for a political architecture. Already these connotations are slipping and sliding into one another.

Now consider the word *program*. Its etymology refers first to a "public edict," and in the early modern era, it also comes to mean variously a plan or scheme, a list of events to be presented, a menu of proposed political ideas, and a way to organize how people will occupy architectural space. Only after World War II does "to program" mean "to write software." For architecture, computation, and politics, the "program" has central significance as a design problem and governing technique. The triangulation of designed site, designed action, and designed polis traces that of "plot": platform and program overlay one another asymmetrically. For example, an architectural program might be defined as an intended organization of *Interfaces* in a particular arrangement so as to coordinate social contact and interaction (or prevent it). As a diagrammatic image, an architectural program indexes the significance of that organization. A software program is a set of instructions that a designer gives to computational systems with the intention of coordinating that system's internal and external interfaces in relation to itself, to compatible systems, and to *Users*. An interfacial image of that program, usually the graphical user interface (GUI), summarizes, reduces, and makes those instructions significant for *Users*. And clearly today, these two kinds of programs intermingle. In many respects, what society used to ask of architecture—the programmatic organization of social connection and disconnection of populations in space and time—it now (also) asks of software. We will return to that shift more than once in the following chapters, and we will have to question what is or isn't the remaining work of physical architecture in light of this. Among what remains is the active contingency of programs, both hard and soft.

A recognition of platforms as a third institutional form, along with states and markets, situates the convergence of its architectonic and computational forms in a more specific and fundamental way. A central argument of this book is that the "political program" is not only to be found in the legal consensus (or dissensus) and policy admonitions of traditional "politics" but also in machines directly. This is where the global-scale arrangement of planetary-scale computing coheres into The Stack, and how the convergence of the architectural and computational design logics of program directly contributes to that system. For our purposes it is far less important how the machine represents a politics than how "politics" physically *is* that machinic system. The construction of platforms draws in, to varying and contingent degrees, strong connotations of "design" (design as in to "designate," and to govern through material intervention) and, in this platforms are plots, and (per Singleton) also diagrams that "ensnare" actors in their fatal outcomes (*design* as in "to have designs on something," to trap the *User* just so). At the same time, platforms are not master plans, and in many respects, they are the inverse. Like master plans, they are geared toward the coordination of system *Interfaces* into particular optimized forms, but unlike them, they do not attempt to fix cause and effect so tightly. Platforms are generative mechanisms—engines that set the terms of participation according to fixed protocols (e.g., technical, discursive, formal protocols). They gain size and strength by mediating unplanned and perhaps even unplannable interactions. This is not to say that a platform's formal neutrality is not strategic; one platform will give structure to its layers and its *Users* in one way, and another in another way, and so their polities are made. This is precisely how platforms are not just technical models but institutional models as well. Their drawing and programming of worlds in particular ways are means for political composition as surely as drawing a line on a map. However, as opposed to the public rights of citizens in a *polis* and the private rights of *homo economicus* in a market, we are severely lacking in robust and practical theory of the political design logic of platforms, even as they remake geopolitics in their image (or demand a different language to describe what the political is now or ever was). What we can know from the outset is that an essential logic of platforms is a reconvergence of architectural, computational, and political connotations of "program" back into one: the design logic of platforms is the generative *program* that is equally all three types at once.

At a more mechanical level, a platform is also a standardized diagram or technology. Its structure and the paths of interoperability that hold it together can't be considered outside of the regularization and rationalization of how it connects to the outside world. As infrastructure, a platform's regularity is often guaranteed less by laws than by technical protocols, and this is one of several ways that the sovereign decision is built into the platform's interfacial partitions and surfaces. This kind of intrasystemic standardization was essential to the epochal metatechnologies of industrialization and post-Fordism, revolutionizing the manufacture, distribution, and consumption of

massive quantities of identical tangible and intangible items. Because protocols are in place to standardize physical and immaterial properties of integral components and discontiguous manufacturing processes—from the width and direction of grooves in a screw, to the costs of stamps and the nomenclature of international postal zones, longitudinal mean times, cryptographic keys for international monetary transfers, stochastic synchronization of data transfers, and so on—the pace and predictability of industrialization could unfold as it did.[6] Artificial standardizations become naturalized as if they were always the measure of things. This kind of complementarity between technique and thought is familiar to adepts of Michel Foucault, Max Weber, Friedrich Kittler and Sam Walton. Standardization drives logistics, and logistics in turn enables geopolitical ambition and momentum. Innovations in munitions standardizations, allowing soldiers to quickly disassemble and repair guns on the battlefield with standard parts, contributed for better or worse to American military prowess in the nineteenth century and its ability to defend a hemispherical doctrine posited by a Virginia farmer, James Monroe. We appreciate the role of railroads, telegraphy, and telephony networks as the infrastructure of globalization, and their speed for the acceleration of the modernities of space and time, but perhaps we underappreciate the metastructuring importance of mundane anonymous standards to turn isolated mechanical inventions into infrastructural innovations (e.g., railroad gauges and spike lengths, timetable templates, the semiotics of graphical interface feedback conventions, transmission line materials, arbitrary telegraphic languages, packet-switching protocols, country codes and area codes, the fixed numeration of money itself, and so on). The centrifugal standardization of *how* individual components interrelate and assemble into higher-order systems, whether physical or informational, is as important as *what* any part or component may be. This is how platforms can scale up. To engineer systems that coordinate the shuttling of units from one point to another with efficiency, adaptability, and flexibility is to compose within the rules laid down by other systems, larger and smaller, with which interaction is required. If two different systems share common protocols, then the subsystems of one can interoperate with subsystems of another without necessarily referring to any metasystemic authority. Systems swap material in this way, such that intermodality and intramodality come to enable one another: no standards, no platform; no platform, no Stack.

The design of protocols, platforms and programs can be as speculative as needed, but the generativity of standards remains. Protocological interoperability works not only to componentize tangible things, but also to represent undetermined relations between things, events, and locations and to provide the means to compose that traffic in advance. In some cases, these are formal notational systems, and the most ingenious are not always the most widely adopted, and sometimes those adopted become so naturalized that they disappear into the fabric.[7] By design, systemic standardization is enforced by fixed physical measurement and procedure, and perhaps here most

particularly, the paradoxical tendency of platforms to control and decontrol at the same time is most evident. For example, the formal urban grid in a major city is for the most part rigid and inflexible, but precisely because of this linear and universally authoritarian topography, it affords both maximum tumult of dynamic horizontal interchange in the street plan as well as vertical recombinant programmatic complexity in the skyscrapers that pop up in each of its cells (more on this in the *City* layer chapter).[8] Similarly, it is the legal and practical standard size of the humble paper envelope that makes it possible for it to shuttle messages both discrete and discreet; like the urban grid, the envelope's power is in its dumbness. In the 1970s as the world's cities began to more fully merge into the networked hierarchies of today with the widespread standardization of very-large-scale envelopes, made of steel instead of paper, in the form of fixed proportion and attribute shipping containers. Containerization migrated the packet switching from telecommunications onto the transit of physical objects (or perhaps the other way around). It traded the standardized, linear traffic program of the grounded asphalt grid for another, now smoothed into liquid shipping lanes, pacing big packets of objects back and forth across the avenues of oceans.

10. How Platforms Work

Platforms centralize and decentralize at once, drawing many actors into a common infrastructure. They distribute some forms of autonomy to the edges of its networks while also standardizing conditions of communications between them. Many of the defining cultural, political, and economic machines of our time operate as platforms (from Google to transnational political theologies). Platforms are formally neutral but remain, each and every one, uniquely "ideological" in how they realize particular strategies for organizing their publics. They are identified with neoliberalism (not without reason), but their origins lie as much within the utopian megastructures of 1960s experimental architecture, counterculture cybernetics, Soviet planning schemes, and many other systems of sociotechnical governance, both realized and imagined. Platforms are infrastructural but rely heavily on aesthetic expression and calibration. A platform's systems are composed of interfaces, protocols, visualizable data, and strategic renderings of geography, time, landscapes, and object fields. For stack platforms, they also include a predominant architecture of interoperable layers. Even as the majority of the information they mediate may be machine-to-machine communication (as, for example, today's Internet), the specific evolution of any one platform, in the ecological niche between the human and inhuman, depends on how it frames the world for those who use it. It draws some things in and draws other things out, but foremost a platform is a drawing and framing machine. Our interest, however, is not to critique platforms as aesthetic works but to identify the work that aesthetics does in their development,

and through this to clarify how some existing (and potential) platforms are worthy of our critiques.

Platforms might be analyzed in many different ways, and another book might make a more thorough contribution to a very needed general theory of platforms than this one can. In order to discuss The Stack as a platform, however, it is necessary to identify some typological characteristics that all platforms might share in common. These would characterize platforms in relation to other technologies (such as individual machines, executable programs, fixed infrastructure, legal mechanisms, or social norms) and in relation to other institutions (such as states, bureaucracies, and corporations). I list here seventeen criteria and qualities of platforms (a nice prime number). The list is by no means final or exhaustive, but taken as a whole, the shape and function of platforms as both technical and political-economic forms are more clearly specified, especially in relation to The Stack. Some of the criteria listed look like basic principles of second-order cybernetics, others of software application design, and others of any networks-savvy political science. As such, "platform theory" is probably less about inventing new attributes from scratch than it is about observing that recognizable common practices already do constitute platforms as an institutional and technical norm at the scale of states and markets:

1. As opposed to other macrogovernance institutions, platforms do not work according to detailed premeditated master plans; rather they *set the stage for actions* to unfold through ordered emergence. Bureaucracies, by contrast, are systems that are also dependent on strict protocols and interfaces, but they operate by premodeling desired outcomes and then working backward to codify interactions that would guarantee these: means are a function of ends. Platforms begin by fixing equally strict means but are strategically agnostic as to outcomes: ends are a function of means.
2. Platforms are based on a *rigorous standardization of the scale, duration, and morphology of their essential components*. The simplicity and rigidity of these standards make platforms predictable for their *Users*, but also allow them to support idiosyncratic uses that platform designers could never predict. The formal politics of platforms is characterized by this apparent paradox between a strict and invariable mechanism (autocracy of means) providing for an emergent heterogeneity of self-directed uses (liberty of ends). The emergent politics of any one platform may largely be a function of how it strategizes the relationship between standards calibration and the perceived self-interests of its stakeholders.
3. This standardization of essential components produces *an effect of generative entrenchment* by which one platform's early consolidation of systems (formats, protocols, and interfaces) decreases a *User*'s opportunity costs to invest more and more transactions into that particular platform, while it increases the costs to translate earlier investments into another platform's (at least partially) incompatible systems.[9] The ongoing

consolidation of systems and reduction of transaction costs leverages that advantage toward increasing the robustness of that platform's unique requirements.

4. Standardized components may also be *reprogrammable within constraints* by *Users*, allowing them to innovate new functions for machines that are composed, at least partially, of preexisting platform systems. The systematic reuse of platform systems allows for the development of complex products based on virtual components, reducing development risks, costs, and project duration. For that innovation, the ratio of what is newly introduced by the *User* versus what is reused from existing platform systems may be extreme in either direction, though neither ratio directly corresponds to the intrinsic novelty of any one innovation's new functions.

5. The design and governance of platforms often relies on *formal models* to organize, describe, simulate, predict, and instrumentalize the information under its management. Those models may represent a rigorously discrete view of the platform's internal operations, its external environment, or, most likely, some combination of the internal and the external that measures platform performance according to metrics evaluating its outward-facing systems.[10]

6. Platforms' mediation of *User*-input information may result in *an increase in the value of that information for the User*. Platform network effects absorb and train that information, making it more visible, more structured, and more extensible for the individual *User* or in relation to other *Users* who make further use of it, thereby increasing its social value. At the same time, it is likely the platform itself that derives the most significant net profit from these circulations in total. Each time a *User* interacts with a platform's governing algorithms, it also trains those decision models, however incrementally, to better evaluate subsequent transactions. An economically sustainable platform is one for which the costs of providing systemic mediation are, in the aggregate, less than the total value of input *User* information for the platform. Platform economics provides then two surpluses: (1) *User surplus,* in which the information is made more valuable for the *User* once involved with the platform at little or no direct cost to that *User*, and (2) *platform surplus*, that is, the differential value of all *User* information for the platform is greater than the costs of providing the platform to *Users*.[11]

7. Like centralizing systems, platforms consolidate heterogeneous actors and events into more orderly alliances, but they themselves are *not necessarily situated in a true central position* in relation to those alliances in the same way that, for example, a master planning committee or federal capitol building would be. Like some decentralized systems, platforms rationalize the self-directed maneuvers of *Users* without necessarily superimposing predetermined hierarchies onto their interactions. The centralization-versus-decentralization dichotomy may therefore be illusory in many cases (and not in others) in that the choke points where a platform incentivizes commitment and leverages its advantages over other options may be even more widely distributed than all of the *Users* that it organizes.

8. The generic universality of platforms makes them formally open to all *Users,* human and nonhuman alike. If the *User's* actions are interoperable with the protocols of the platform, then in principle, it can communicate with its systems and its economies. For this, *platforms generate User identities whether they are desired or not*. Platforms can provide identities to *Users* who would otherwise not have access to systems, economies, territories, and infrastructures, such as a person who is not recognized as a political "citizen" by a location, but who is nevertheless included in communication by platforms that are agnostic to the legal status of its *Users*. At the same time, platforms can also name, enumerate, track, and capitalize the identity of *Users* who would rather remain anonymous. For the former, the required provision of *User* identity may be seen as an advantage of platforms and for the latter as a disadvantage.
9. Even as platforms guarantee identities to the *Users* of its systems, for better or worse, they do not provide these evenly or equally. *A platform governs one User differently than it does another.* An *Interface* that may open a space for one *User* also closes it off to another. An interface that may be open for one *User* at one moment may be closed at another. This differential is a core technique of how platform sovereignties normalize the exceptional reversibility of the partition. What may be an interiorizing partition ("enclave") for one *User* at one moment may be an exteriorizing partition ("camp") for another at another moment.
10. An ideal platform architecture is one that produces a strategic minimum of new content into its own communication economy. *An ideal platform is like an empty diagram through which Users mediate new and archived information*. A search engine, for example, does not produce new Internet content for its *Users*, but rather structures the value of content that other *Users* produce. (If medicine were reconceived as a platform, it would obviously provide new critical information to *Users*, that is, patients and doctors, as well as organize medical knowledge to date, but it would, in principle, focus the point at which new diagnostic or therapeutic expertise is most crucially required and support it with, for example, highly structured patient data and precedents from the literature).[12]
11. *Any structuring component of an ideal platform architecture is replaceable by a new component*, and so the platform could, piece by replaced piece, evolve into something entirely different while retaining its essential shape. As in Theseus's paradox, every plank of wood in a mariner's ship is replaced over time by new wood, and yet the new ship occupies the same virtual place as the old ship and so it still is "Theseus's ship." The same operation holds for platform architecture. Any given component (e.g., layer, protocol, interface) could be replaced, inclusive eventually of all components of the platform in its totality.
12. Platforms may respond to *User* inputs immediately and may draw on archived rules to recursively govern those interactions in real time, or it may act back on those interactions only once some qualitative or cumulative threshold requirement has been met, perhaps by many *Users* at once. *Platforms govern both instantaneously and cumulatively*.

13. Ideal platforms not only act on new interactions according to programmed rules and in relation to archived structured information, but *also serve as distributed sensing systems that incentivize the detection of errors (or mere anomalies), which are interpreted by the platform's formal models*. In principle, what are interpreted as errors will not only update the model's description of the whole, but will also correct the rules by which future interactions are governed. Ideal platforms also treat anomalies not only as errors but as signals of emergent patterns or norms for which some new positive accommodation may be required.
14. The competition between platforms may occur over new tabula rasa space or over the recomposition of one or more existing systems in accordance with a platform's strategy. To date, many successful platforms are those that provide *Users* with new capabilities by making their existing systems more efficient. *Platforms that organize existing systems and information tend to achieve generative entrenchment more quickly* than those that seek to introduce new systems from scratch. *Users* will make tactical use of some platform interfaces to link some existing systems, and in doing so they are incentivized to incorporate more of their own interests within these systems. Subsequent *Users* are incentivized to link their systems to benefit from the network effects set in motion by earlier *Users*, who in turn enjoy increasing network benefits as more *User* systems are incorporated over time. The platform is able to realize platform surplus value from this generative entrenchment.
15. Platforms link actors, information, and events across multiple spatial and temporal scales at once. *Platform ubiquity makes it more robust in relation to some threats, both intrinsic and extrinsic, and more vulnerable in relation to others*. A platform's ability to defend one component or even replace it when it is no longer useful can make the whole more resilient, but it can also then leave individual components vulnerable. The integrated architecture of the platform may also allow internal component-to-component feedback loops to cycle out of control, amplifying the destabilization of the whole apparatus.
16. A platform's actual processes may be very different from how they are understood by their *Users,* who may form mental images of those processes based on their own individual interactions or on how the platform has represented itself to them. *Platforms don't look like how they work and don't work like how they look*. For example, a *User* may understand his or her own interactions with the platform according to the content hierarchies of a GUI that bears almost no relation to how the platform actually structures or sees that interaction. Architects of a typical *Cloud*-based platform may organize the system according to the provision (and strategic throttling) of data through application programming interfaces (APIs) that make many different kinds of platform effects possible, the sources of which may be opaque to the most common *Users* or even to other components of the system.

17. Platform sovereignty may be planned or unplanned, universal or specific, generative or reactive, technologically determined or politically guaranteed. *Platform sovereignty is automatic under some circumstances and highly contingent under others, and it may function differently in relation to different components of the platform system*. The conditionality of these is a function of how platforms relate to other political, technical, and economic institutions that also manage something (or someone) that is also organized by that platform. When two or more platforms mediate the same thing, site, or person, both making claims on it and providing sovereignty to it, then the two sovereignties generated may be mutually constrained. While one of these forms of sovereignty may be universal in relation to the platform that issues it (always subject to the inversions and reversals noted above), it is also only partial and provisional in relation to other platforms (if it is even recognizable by them at all). These differences may be between how two platforms identify the same thing or between how two different components of the same platform (or different components of different platforms) address that thing. While this multiplication prevents any one *User* from enjoying unlimited universal sovereign privileges, it also tends to prevent any one platform from capturing all sovereignty-generative components within its whole and monopolizing how sovereignty is made, and for whom and what.

To further outline the platform principle, others can add to and modify this provisional list. Some may want to include, for example, demonetization: how platforms sometimes strip certain things of their scarcity and hence exchange value. Some may focus on how platform design can never account for the accidents that actual platforms bring, but also conclude that well-designed platforms can turn accidents into assets. Some may want to specify how and when a *User* has rights of *exit* and *entrance* from and to platforms. Can you leave, and can you get in? Others may want to explore the organizational logics of technical platforms as exemplified by street grids, punch cards, spreadsheets, circuit boards, and so on. Others may come at it from the other side and ask whether standardization works best when predictable outcomes are desired, whereas customization works best when not, and ask how the generic quality of platforms can and cannot do both at once. The Stack is a machine that becomes a state, but it is also how both become platforms, or at least, as one condition around which their armatures are forced to evolve in relation to platforms. As we will see in the chapters ahead, as platforms like The Stack appropriate technologies of sovereignty previously guaranteed to and by the state, the contemporary coevolution of these organizational forms may be punctuated by new disequilibriums. First, we need to better understand the genealogy of platforms as political models and how they have been deployed (successfully and unsuccessfully) as political machines.

11. Stack as Model

Stacks are a kind of platform that also happens to be structured through vertical interoperable layers, both hard and soft, global and local. Its properties are generic, extensible, and pliable; it provides modular recombinancy but only within the bounded set of its synthetic planes. It is an autogenerative parametric topography, but one that grows precisely through an initial subdivision of technologies into planar layers and then through an autocratic consolidation and rationalization of these through internal interfaces and protocols. As for any platform, that consolidation is driven less from centrally planned legal prescription than through the algorithmic conduction of self-directed behaviors by free-range *Users*. The Stack discussed in the following chapters is a vast software/hardware formation, a proto-megastructure built of crisscrossed oceans, layered concrete and fiber optics, urban metal and fleshy fingers, abstract identities and the fortified skins of oversubscribed national sovereignty. It is a machine literally circumscribing the planet, which not only pierces and distorts Westphalian models of state territory but also produces new spaces in its own image: clouds, networks, zones, social graphs, ecologies, megacities, formal and informal violence, weird theologies, all superimposed one on the other. This aggregate machine becomes a systematic technology according to the properties and limitations of that very spatial order. The layers of The Stack, some continental in scale and others microscopic, work in specific relation to the layer above and below it. As I have suggested, the fragile complementarity between the layers composing The Stack is discussed both as an idealized model for how platforms may be designed and as a description of some of the ways that they already work now. The metaphor and the machine are diagrams made real in the megastructure.

If you start looking for them, "stacks" are everywhere. In a way, the Earth itself is a spherical stack, from its molten core, to the lower and upper mantle, to the crust on which organic life evolved under the troposphere, stratosphere, mesosphere, thermosphere, and exosphere. Humans evolved between two and only two of these layers. Charles and Ray Eames's famous "Powers of Ten" films for IBM showed generations of high school students how to start from one everyday spot and from there think down to 10^{-9} meters and up to 10^{23} meters, from quarks to walls of galaxies, and back again. In a way, their presentation is a kind of telescoping stack. Archaeology organizes and depicts the temporality of unearthed assemblages according to the Harris matrix, and its interlocking principles of original horizontality, original continuity, and stratigraphic succession. The Marxian model of base and superstructure provided another verticalized image of social totality, whereby economic structural causality flows bottom-up, from foundational technical processes of production, valuation, and relations in the base, to their ultimate expression in cultural and political institutions, as superstructure. Marx wanted to model historical cause and effect, but history is full

of images of society organized instead into static stratified layers of arbitrary hierarchies (Albrecht Dürer's 1515 woodcut *The Triumphal Arch of Maximilian I* comes to mind). Many contemporary technical systems work on stack principles, including smart grids that segment a power layer, below a communications layer, below optimization and applications layers. Examples are plentiful, and while some are recognizable as software stacks, others are fuzzier, more heterarchical than hierarchical.[13] Beyond software, is the generic composability of any one layer in relation to another within a generative vertical platform that may help qualify systems as stacks.

Stack architectures are also conceptual strategies for design, not just for description, and they are not only conceptual architectures, they are models for actual architecture as well. Le Corbusier's *Five Points toward a New Architecture* is a strong stack, as embodied in Villa Sovoye and the vertical platform for five essential but undetermined programs.[14] The building may be "a machine for living in," but the Five Points stack is the machine for making machines. Constant's ever-changing New Babylon speculative urban system was redesigned again and again over the span from *Sputnik* to the OPEC embargo. It changed shape constantly, but one durable characteristic was the notion of a new city designed on top of the old one in two exclusive stacked layers. It imagined the new city as a landscape of vast multilayered networks and as continuous territories of ludic interfaces and opportunities, defined not by relation to a master ground plane but to the horizontal and oblique vectors of movement up and down the exploded sectional program. It was to be based not on functional regulation but on the feedback systems of play and serendipitous interaction. This project in turn inspired Rem Koolhaas's revision and expansion of Mies van der Rohe's sectional diagram into a generic principle of scale, for which the vertical juxtaposition of unlike programs in a single structure allows them to interoperate with as much mutual transparency or opacity as might be required, or which could be staged for optimizing spatial performance. This is seen perhaps most dramatically in the horizontal skyscraper OMA's (Office of Metropolitan Architecture) 1972 conceptual project, Exodus: Voluntary Prisoners of Architecture, in which residents pass from layer to layer as they move through the discrete biopolitical stages of their lives.[15] Other architectural stacks are even more graphically explicit, such as Gordon Matta-Clark's slices through stories of buildings, Robert Smithson's concentric-layered world maps, and the stratified landscapes of MVRDV's Hannover 2000 exposition pavilion that stacked and segmented artificial nature and program into a hyperdense world-in-a-box. Elsewhere, stack perspectives erupt uninvited and unintended. The verticality of flattened systems is seemingly uncontainable. While world maps render space in *x*- and *y*-axes, no linear geometry without thick verticality could represent the most entrenched geopolitical conflicts, rational and irrational alike. Consider Israeli architect Eyal Weizman's multidimensional maps of the overlapping and interweaving claims of sovereignty in Israel-Palestine, showing that no horizontal cartographic linear delineation, or any regular vertical elevation all by

itself, can finally describe, let alone govern, the multidimensional violence of that particular jurisdiction-intensive politico-theological matrix. Multiplications of the plane and rotations of perspective that move the flattened into the vertical are prevailing. Everywhere are stacks, good ones and bad ones, big ones and little ones, and many of them agglomerating into larger and larger platforms.

The architecture of The Stack, this one particular megastructure of planetary-scale computation, is an interoperable physical-informational system of systems, distributed under, onto, and over the surface of the globe, with its layers organized into a patchy, uneven vertical section. As said, The Stack is composed of geologic, humanistic, and mineral layers charging feedback loops between these. As a cybernetic landscape, The Stack composes both for equilibrium and for emergence, one oscillating into the other for diagonal purposes in barely accountable rhythms. The state conditions (and literally for governance, the condition of the *States* that its platform logics describe in advance) are derived both from stacks as abstract diagrams and, through its unenumerated operations, as real existing machines. In turn the infrastructural sovereignties of The Stack may, in principle, emerge from either of these. It can be derived from its career as accidental megastructure, which itself may or may not be the model for geogovernance to come, or from its immediate, projective, and potential designability. It goes both ways. Today, The Stack that we can analyze frames the one we can conceive, just as the one we can conceive frames the one we are beginning to realize. Alternatives are conveyed from its distortions.

The Stack's disciplining of communication as an ecology of isomorphic techniques makes the world appear as a system that demands from us a constant redesign of its ever more granular interoperations. The history of these technologies is also then the history of multiple competing communication standards. Protocol politics is always rough trade because to control the standard is to influence the economies it enables, which is to influence how they interrelate with other systems and the meta-economies those interoperations in turn give rise to. As should be plain from current events, the interweaving of otherwise incommunicative hard and soft systems into new assemblages continues apace, and so the politics of standards (e.g., open source, intellectual property, net neutrality, encryption) becomes integral to the "democracy" of infrastructure and to the little sovereignties of everyday life. Looking back, it is not coincidental then that formal systems theory and information theory appear historically concurrently and are part of the larger crest of cybernetics. The discernment of information as a first-order principle of material difference in the twentieth century would come to all but consume the very definition of *systems tout court*. The study of information bridged linguistics, symbolic logic, biology, chemistry, art, literature, and the theory of calculus with the practical engineering problems of automated logarithms, algorithms, cryptography, and long-distance signal transmission relay. In turn, the modeling of all of these and more as forms of information, as well as the conception of distributed