

Boundary work in Internet governance: the historic role of layers and the E2E argument

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i. Introduction

The Internet is inherently marked by boundaries and borders.

In general terms, the architectural design of the Internet protocol suite is entirely based on a set of abstract, autonomous (yet interdependent) and well defined functional layers. Each layer individually plays a clearly-defined role (separated by invisible conceptual boundaries) for data communication and exchange between hosts connected through the Internet (RFC 793). Additionally, the underlying networking infrastructure and the hosts as well as end-users in the margins are inevitably tied to geographical spaces separated by borders, being subject to the sovereign authority of nation states (Svantesson, 2016). Nonetheless, despite that structural reality, the Internet was designed and functions to offer end-to-end connectivity (Saltzer, Reed & Clark, 1981), following routing and addressing schemes that do not conform to the traditional segmentation of the physical territory of the planet (RFC 1654; RFC 882).

Over the last twenty years the effects of boundary work over the Internet have marked most of the debates from a governance perspective, but the boundary work of creating and re-creating the field of practice and scholarship has been less examined. This essay is an attempt to deal with how Internet governance's conceptual boundaries are framed, constructed and negotiated.

Departing from a framework on boundary work inspired by international relations practice theory (Hofius and Kranke, 2021), the paper explores how *the Internet made its boundaries*, that is how as an entity/artifact it strove to define its shape which was not only technical, but also institutional and value ridden. We do so by examining boundary work stemming from the combination of a layered-model approach and the E2E principle that have guided the development and evolution of the Internet. It will also analyse *how boundaries make the Internet*, following Abbott's (1995) "Boundaries come first, then entities" (p. 860). The fundamental question we aim to answer is: To what extent have the layered model of the Internet and the E2E principle defined boundary work around the Internet and Internet governance? By answering this question, the paper seeks to provide insights on how old and new forces clash around the definitional borders of the Internet in material (infrastructural) terms and on how those clashes feedback into (and are reinforced by) "boundary making, remaking and unmaking" in Internet governance as a field of inquiry.

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The paper is divided into five segments. Section "ii" presents the prospects of approaching Internet governance from the perspective of boundary work. Section "iii" describes existing boundaries and borders that are more or less visible in the literature produced over the past two decades: From the physical borders of geography and the way they are reflected into sovereign jurisdictional spaces (and vice-versa), to the boundaries that exist among the different disciplines that deal with Internet governance (including in multi-/transdisciplinary endeavors such as STS). Section "iv" explains how the layered approach and the end-to-end argument have been powerful forces guiding boundary work in the field. Section v. discusses boundary work from a layered approach and conceptual and policy efforts discussed in the previous sections, as well as the practical implications for its governance. We conclude (in section "vi") by discussing the challenges inherent to any exercise on concept formation in the social sciences (Gerring, 2001; Goertz, 2005) in a preliminary attempt to provide greater theoretical precision about Internet governance as it has been evolving across the decades.

ii. Boundary work applied to Internet governance

Scholarship around boundary work is concerned with the construction, blurring, teardown, maintenance and reconstruction of boundaries that divide human activities, groups and institutions in dynamics of inclusion and exclusion, differentiation and integration, collaboration and competition. Those phenomena encompass things as diverse as sociopolitical governance and the development of epistemic communities, with varying degrees of materiality. While sovereign jurisdictional spaces generally count on "highly institutionalized and reified" boundaries (i.e.: physical borders), intellectual demarcation and the formation of more or less closed epistemic communities count on "less visible boundaries that nonetheless influence how global cooperation is done or not done" (Hofius & Kranke, 2021:2-4).

One fundamental issue in boundary work in social theory since the work of Andrew Abbott (1995) is the relationship between a boundary and an entity or unit. Is the boundary what defines the entity or is the entity a defining feature of the boundary? Abbott argues that this relational approach is a two way process, but he fundamentally challenges the idea around the capacity of entities to define boundaries. Abbott and others (Leonardi, 2010; Orlikowski and Iacono, 2006) have shown how in different fields it is boundary work that has defined/redefined the characteristics of professions and fields of activity (Abbott, 1995), geographical spaces (Benjaminsen et al, 2020) and policy issues, such as migration (Cassidy, 2020; Schmidt, 2021).

Borders and boundaries are not the same. While the drawing of borders is one of the most conspicuous manifestations of boundary work, it is one which generates the clearest demarcations and which acts a dividing line in most cases. As noted by Hofius and Kranke (2021), most of the boundary work (in the discipline of International Relations as is their case) has focused on the exclusionary logics and fragmentation, while boundary work is less of a binary nature and more of a relational, and dynamic approach.

Following this dynamic, relational and practice oriented notion of of boundary work described earlier (Hofius and Kranke, 2021), we interrogate how this operates in Internet governance by those who are *doing* it (van Eeten and Mueller, 2013) through the experience of shaping its infrastructure, protocols and those exercising gate-keeping functions in any of its layers

through different bottlenecks and control mechanisms, such as paywalls, firewalls, registration, and objects (DeNardis, 2014). The Internet and the ecosystem built upon and within the network evolves as a function of the way it is used (Abbate, 200) by individuals and corporations from the private, public and civic sector. These uses are permanently reshaping the boundaries of the Internet. To add additional complexity to the mix, the governance landscape has become so densely populated with institutions and regimes that it is hard to draw a line between the different instances where Internet governance takes place.

In our view, the early DARPA project for the Internet configured and imagined the space for a distributed network of networks which took two decades to materialize into the TCP/IP and the protocol infrastructure that underlies the Internet (Abbate, 2000; Waldrop, 2012). Once the Internet was consolidated as an entity, as a global network of networks that has been built outside the margins of existing policy and regulatory frameworks applicable to technological development, the disciplinary boundaries of Internet governance have been built around “engineering” practices and subsequently around the processes and practices of governance institutions (Mueller, Mathiason & Klein, 2007).

This understanding is grounded in the wealth of literature that engaged the last twenty years, more or less explicitly on how the norms and the institutions that were being shaped and disseminated globally were defining a new policy field based on the architectural principles of the Internet. (ten Oever, 2021)

From another related theoretical perspective to that of contemporary boundary work in International Relations (IR), Social and Technology Studies (STS) take into consideration the materiality of the Internet as an artifact and its affordances to shape practices and its social environment, underscoring once again the role of the entity that defines its borders. Yet, this literature has also promoted another interpretation of these processes, whereby the social systems where the Internet has been implemented have, in turn, reframed notions around the network itself, its individual components and the governance of that ecosystem in multiple dimensions.

While STS approaches to Internet governance have addressed this relationship between the environment shaping Internet technology’s core components, this literature (mainly through the line of De Nardis et al, 2020) has emphasized the role of infrastructure and its control as a defining feature of governance. Such an approach is useful to understand the political struggles that revolve around the control of the material and immaterial infrastructure of the Internet. But there is scant work, even from a disciplinary lens such as that provided by STS approaches, on how boundaries are established, erased and re-enacted beyond “border control functions” into more fluid and relational approaches.

The following section pursues how Internet governance scholarship has addressed more or less tacitly the boundary work concerning Internet governance.

iii. Boundaries in Internet governance

Borders in the physical world (and their effects or not over the Internet) and boundaries (or lack of boundaries) in Internet-related scholarship have defined its governance field: from a

policy perspective, bearing in mind the early disputes between a utopian conception reflected in the libertarian discourse of Barlow's "Declaration of the Independence of Cyberspace" (1996) and Goldsmith & Wu's 'realist turn' (Mathiason, 2007) with "Who controls the Internet? Illusions of a borderless world" (2006), which culminated with Mueller's "Networks and States" (2010). But also from a more academic perspective focused on methodological and theoretical discussions related to the prospects and limits of multi-/transdisciplinary inquiry around Internet-related issues (Denardis, Musiani, et. al, 2020). In that sense, Internet governance research and practice has flourished in the past three decades and has been an important discipline to guide policy-making processes surrounding the Internet, including by providing a much more nuanced approach to the relevance of sovereign borders as variables of concern for Internet-related policy making processes (De La Chapelle & Fehlinger, 2016; Svantensson, 2017).

Despite that evolution, Internet governance is still today a fuzzy expression.

Conceptually, Internet governance is marked by the co-existence of, on the one hand, multi- and transdisciplinary endeavors in an attempt to tackle the complexity of the subject matter, and on the other, by traditional research and scholarship that takes place within clearly defined disciplines associated with STEM, Law, Economics and Social Sciences (to name only a few examples). In institutional and policy terms, Internet governance is genuinely polycentric (Scholte, 2017) and involves the daunting task of coordinating the collective action of the different components of a complex ecosystem. It is marked by relations of political cooperation and disputes around the appropriate *locus* for decision-making processes as well as around sources of authority and power for all things pertaining to the network.

Abbate's work (2000) is probably one of the most focused exercises of boundary work around the Internet. Here the author explicitly ascertains to "cross the divide that exists between narratives of production and narratives of use" (Abbate, 1999:4) concerning the Internet. "Inventing the Internet", however, cannot be disentangled from Internet governance as the Internet (as an artifact) was developed and evolved as a function of the interdependent relations established by network operators among themselves, i.e. the networking practices, as well as with the entities in charge of ensuring the coordination and coherence of the system as a whole (namely through the governance of critical Internet resources).

The early days of IG policy and scholarship were marked by the expansion and then the institutionalization of processes concerning Internet resources around different organizations, in what could be defined as a strict approach to Internet governance. Mueller and Badiei (2020) describe this first phase as "discovery" and "exceptionalism". In a nutshell, Internet governance as a field of inquiry has been built as a function of the institutionalization of a private sector-led governance entity to manage the Internet's Domain Name System and the DNS Root Zone, where most governments played a minor role, except for the conspicuous case of the United States (Mueller, 2002).

The tension surrounding the special status of this government resonated into the WSIS process and feedbacked into the creation of the UN-backed Internet Governance Forum (Drake, 2016). What became evident for some - and for a while - was that the Internet was

overriding traditional notions of State sovereignty with new epistemes, new institutions and a new set of actors which aimed to redefine and transform the boundaries of communities, market rules and power. In opposition to that trend, sovereign states have permanently strived to govern the Internet by invoking sovereignty concerns, through the lens of existing jurisdictional practices. Those practices are based on norms and legal instruments which have been consolidating since the late 19th century and which are relevant for international politics, but are in strike conflict with an international order (or regime) for Internet governance that is (and will permanently be) in flux.

Both in policy as in intellectual terms, a clear line has separated Internet governance in two worlds, marked on the one hand by traditional top down governance structures associated with sovereign states (both at the national and the global level) and, on the other, the (supposedly) revolutionary bottom up exceptionalism associated with multi-stakeholder governance structures created around the Internet.

As Mansell (2014:146) notes "there is remarkably little common ground at present between those proposing top down, as distinct from 'bottom up', institutional arrangements for governing communications networks". Evidently, there are fifty shades of gray among those ideal extremes, and even within each "governance model" there is not a one size fits approach that would encompass all the complexity of governing the digital ecosystem. DeNardis & Raymond (2013:12), for instance, catalogue six functional areas and forty-four tasks attributed to different players distributed across the layers of the digital ecosystem in an attempt to classify different forms of multi-stakeholder governance. At the end of the day, as in any traditional governance arrangement (be it state-centered or not), the authors produce a map of multi-stakeholder arrangements based on (a) the nature of the stakeholders involved as well as (b) the nature of authority relations established between/among them.

Moreover, the development of "Internet governance" as a field of inquiry is characterized by a "peculiar disjunction" as Van Eeten and Mueller would put it: *researchers in fields that substantively are studying Internet governance have consistently shunned the term. Researchers that self-identify their work as Internet governance have not seen the need to expose themselves to work on actual Internet governance* (2013:11). According to the authors, self-proclaimed Internet governance scholars focus too much on centralized institutions (such as ICANN, the WSIS and the IGF) and the inherent rules, procedures and working approaches (with a special attention to the prospects of multi-stakeholderism for global governance). But, in reality, according to them, much more important Internet governance processes take place elsewhere (in fields such as telecommunications policy, information security and cyberlaw): For instance, network neutrality, market competition of Internet services provision, cyberwar, intellectual property, freedom of expression, censorship and privacy.

In an attempt to re-think and change the boundaries (sic) of Internet governance, the authors suggested that Internet governance be less concerned of institutions and more focused on a "wealth of disjointed messy and globally distributed processes that together produce governance (...)" in a context of "(...) low formalization, heterogeneous organizational forms and technological architectures, large number of actors and massively distributed authority and decision-making power." (2013:10-11). Bearing in mind that the Internet (as of today) is

an ensemble of more than 80 thousand networks, dozens of thousands of connectivity services and application providers used by more than four billion people scattered around the World, one might say that Van Eeten's and Mueller's effort to bring "governance back into Internet governance" has been a first attempt to delimit the boundaries of what is Internet governance.

Based on those two realities (one related to the day-to-day operation of networks that form the Internet and another related to the institutional settings surrounding the Internet-enabled ecosystem), Internet governance has struggled between two extremes: a narrow conception focused on distributed network management and loose global coordination, and an expanded one that encompasses everything directly or indirectly related to the Internet. This last one addresses from protocol development and the management of critical Internet resources to the public-policy aspects related to the use of different Internet-based technologies. DeNardis (2014) dealt with the challenge of providing a working definition of Internet governance that is neither too narrow, nor too broad: Internet governance for DeNardis entails both the politics around the definition of policies and rules to govern the Internet (in multiple levels) as well as the exercise of authority by the implementation of such policies and rules in the different spaces that form the Internet ecosystem. Such a renegotiation of the IG as a concept is concerned with points of design, coordination, and control, as well as the different functions performed by different actors within the Internet ecosystem (Denardis et al, 2020). Such an exercise of authority and policy development and implementation varies amongst institutional settings at the national, regional and international levels.

Semantically, a neighboring concept (Gerring, 2001) is that of the Internet 'policy field' which addresses a space for interaction between actors, rules and institutions and has been used by Pohle, Hösl & Kniep (2016) to refer to what other authors would traditionally label as 'Internet governance'. In their analysis of the political struggles behind the institutionalization of this policy field in a national context (Germany), they depart from the same constellation of stakeholders, thematic issues and policy developments and controversies as well as approaches to governance that form the bulk of Internet governance scholarship and practice. Nonetheless, the expression 'Internet governance' is not employed throughout their text. Tacitly this is playing with a boundary notion of Internet governance in relation to a national space of stakeholders, norms and institutions.

We will now explore two forms of additional boundary work that have marked the scholarly debates over the last years: the Internet fragmentation issue and the Internet ubiquitousness over the material world with the Internet of Things. The first one is a debate that could be condensed in the catchphrase "the splinternet", framed as a threat to the open Internet (Drake, Cerf & Kleinwächter, 2016), a process that in itself is multicausal and with many underlying meanings and mechanisms that actually shape the issue. These authors identify governmental, technical and commercial mechanisms. The first largely operates with technical and regulatory means using arguments such as data localization, national security, cyber sovereignty, to develop mechanisms that hinder the flow of information and data across jurisdictions. Technical fragmentation can be promoted by governments but falls under the realm of tinkering with TCP/IP protocols, the root zone, routing protocols and the DNS, among others to technically break-up the unicity of the Internet. Finally, the private commercial sector driven by market incentives promotes this fragmentation through the

creation of digital walled-gardens, faster/slower lanes when there is no net neutrality provision, blocking content through intellectual property concerns, among others (Drake, Cerf & Kleinwächter, 2016). There is not one mechanism nor a shared understanding of what the rhetoric of fragmentation actually means, as Mueller (2017) for example contends that the debate is about traditional institutions of government versus a needed global governance approach that promotes institutional innovations beyond the national borders. But the issue takes for granted an imaginary conceptual space of a seamless and unbounded Internet.

The second debate concerns the “Internet in Everything“ (DeNardis, 2020): *The blurring of boundaries between the physical and virtual realms is also blurring understandings and affordances of the internet itself* (p. 188). This second problem of contemporary Internet governance is also manifesting boundary work around the Internet as a technical artifact connecting an increasing number of devices to objects rather than the Internet of connecting people. The dilemmas of an open, inter-operable and following the end-to-end principle of the early Internet are questioned in face of the major implications for security and safety. The Internet under this paradigm needs to bound itself to the new challenges.

In summary, the agenda of the field (both in academic and policy terms) was built around the logic layer of the Internet ecosystem (protocols, identifiers and addressing systems) and its associated institutions (narrow conception), as well as the policy feedback they generated for national, regional and global governance during the 2000s and onwards (enlarged conception). And, as the Internet became a central feature of contemporary life, governance concerns ranging from political economy, socioeconomic development and human rights at the national, regional and global levels, started expanding without limits the range of concerns and the scope of the Internet governance policy agenda.

Part of that can be explained by the fact that Internet governance is like a babel tower: multi and transdisciplinary research and scholarship around the Internet and social phenomena associated directly and indirectly to it gained prominence across the intellectual boundaries of STEM, Law, Economics and Social Sciences (to name only a few) as the proper approach to tackle such a complex ecosystem (DeNardis et al., 2020). Throughout the years, boundaries around IG have been built, erased and rebuilt on a permanent basis by collaboration and competition not only among different stakeholder groups, but also among the academic disciplines that have conflicting conceptions of what the Internet is in the first place. For some, the Internet is the digital ecosystem as a whole; for others, it refers only to the logic layer. For users in general, the Internet is the same as specific services and applications that are built on top of it. But more importantly, those groups also have conflicting views on what governance is. Governance of, governance on, and governance with the Internet are taken instinctively.

The next section is an attempt to identify the root causes of that confusion by examining the contradictory forces that stem, on the one hand, from the layered architecture approach that structures the TCP/IP and, on the other, the E2E argument that underpins the creation of a global network of networks.

iv. The tiered/layered approach and the E2E argument as sources of boundary work in Internet governance

The layered approach and the E2E argument are two forces that lead to the boundary work that has defined the Internet from its inception until today and have had a clear influence on its governance.

RFC 1958 combined with RFC 3439 describe the "architectural principles of the Internet" and "some of the philosophical guidelines to which architects and designers of Internet backbone networks should adhere". Among those principles and guidelines, the notion of multilayered architecture (drawn from software engineering) and the "end-to-end argument" (drawn from computer networking) stand out as the key design issues to enable the creation and operation of a complex system such as the Internet.

A tiered/layered approach to software engineering involves breaking down a complex system into different but interdependent smaller parts represented by different tiers/layers. It serves the purpose of simplifying the description/understanding, management and operation of such systems. In general, those tiers/layers revolve around three main segmented dimensions: the interface between the user and the system; the embedded rules that make the system work; and the data management system. By assigning specific functions to each tier/layer, such an approach allows for tailored intervention in specific segments of the system instead of having to deal with the system as a whole, in a way that ensures flexibility, reusability and scalability. The system is flexible because interventions and innovations in one part of the system can be performed without the need to modify other parts of the system. Such a feature permits the combination and recombination of existing features and building blocks as well as new ones that are developed as needed. Contrary to monolithic systems (in which all components depend entirely on each other), multilayered systems offer higher scalability (as a function of reusability and flexibility in their deployment).

Due to those benefits, the layered approach is behind the development and success of the TCP/IP suite, which defines the parameters for data to be segmented into packets, duly addressed, routed and transmitted/received by entities that are part of the Internet. TCP/IP is segmented into a link layer (responsible for managing data flows within individual networks), an Internet layer (the portion of the system in charge of internetworking and data exchange between different networks), a transport layer (in charge of orchestrating host-to-host interactions) and an application layer (responsible for orchestrating application-to-application data exchange).

By the same token, the "end-to-end argument" - according to Saltzer, Reed & Clark (1981) - is proposed to "guide placement of functions among the modules of a distributed computer system" (i.e.: a computer network or a network of computer networks). In a nutshell, it separates the core and the edges of the network and determines that intelligence shall preferably be placed at the edges of the network in order to keep the core functions (e.g.: the routing infrastructure) as simple and neutral as possible.

As RFC 3439 explains:

"Consider the cost of providing new features in a complex network. The traditional voice network has little intelligence in its edge devices (phone instruments), and a very smart core. The Internet has smart edges, computers with operating systems, applications, etc., and a simple core, which consists of a control plane and packet forwarding engines. Adding a new Internet service is just a matter of distributing an application to the few consenting desktops who wish to use it. Compare this to adding a service to voice, where one has to upgrade the entire core."

Such a characteristic is the reason for the Internet to be conceived as a general-purpose network capable of supporting the development of all sorts of services and applications in the digital ecosystem. As described in RFC 1958: "[I]n very general terms, the community believes that the goal is connectivity, the tool is the Internet Protocol, and the intelligence is end-to-end rather than hidden in the network."

More importantly than that, as connectivity is the goal and the core of the network is tasked with forwarding packets from one network to the other without major complications, the E2E argument is behind the notion of "a global Internet" that is unhindered by geography. The E2E argument then means segmentation and integration in tandem.

In sum, the layered approach and E2E argument are two faces of the same coin, as described by RFC 3439:

"We can see that the end-to-end principle leads directly to the Simplicity Principle by examining the so-called "hourglass" formulation of the Internet architecture [WILLINGER2002]. In this model, the thin waist of the hourglass is envisioned as the (minimalist) IP layer, and any additional complexity is added above the IP layer. In short, the complexity of the Internet belongs at the edges, and the IP layer of the Internet should remain as simple as possible." (RFC 3439, 2.1)

A clear example of how those two engineering principles feedbacked into Internet policy making can be mapped in Yoo (2013). The author scrutinized proposals to guide Internet regulation based on a combination of layering and the place where operational functions are performed in the Internet's topology (as equipment at the core and at the edges of the network are expected to operate different functions across the TCP/IP stack). Focusing mainly on field of competition policy and law, he claimed that,

"many have invoked the layers model to justify subjecting lower layers of the Internet to regulation while largely exempting the upper layers from regulatory scrutiny. Other proposals suggest that network management techniques that violate protocol layering be regarded as inherently problematic. (...) Protocol layering is also frequently lauded for its ability to promote competition in another way. As a general matter, enabling actors to connect without asking permission and to innovate within their layers without affecting other layers is likely to promote competition." (Yoo, 2013:1752-1753)

Back in 2013, Yoo was mainly concerned with the fact that such an approach to policy making seemed to disregard how dynamic and pragmatic the evolution of protocol layering can be vis-à-vis the slower pace with which regulation is adopted and evolved. He concludes that seminal work by underscoring "the importance of not regarding any particular layered architecture as if it were a natural construct" and "the potential dangers of using regulation to enshrine any particular architecture into law." (2013:1770) That caveat is really important bearing in mind the work that is focused on studying the circular relation between the currently existing Internet architecture and technologies and the socio-technical contexts in which those are deployed. As that complex interaction pushes for a permanent feedback loop between technology and policy, the underlying architecture of the Internet is expected to evolve over time (Sollins & Lehr, 2020).

Yoo's work is a good illustration of how the two engineering principles studied in this section represent a central feature for boundary work in Internet governance at-large: the layered architecture approach is about specialization and the definition of precise functional limits across the TCP/IP stack, and the E2E principle - despite also involving separation and specialization - points towards the opposite direction. Beyond boundaries, E2E also aims for the absence or minimization of unnecessary hurdles for data to flow freely from one edge to another on the Internet.

The next section raises some issues for reflection on that tension.

v. Discussion

The infrastructure of the internet is itself now a geopolitical space (Twitter, 2020)

This work has attempted to understand through boundary work theory the boundaries of Internet governance scholarship and practice beyond the discussion of borders based on jurisdiction and sovereignty concerns. It indicated that the layered architecture of the Internet and the E2E that guide its development and implementation are the root elements of boundary work around the Internet and its governance.

There is a dearth of literature on how the ecosystem or environment manages to create the entity called the Internet, which is precisely what boundary work is about. Most of the accounts around the Internet first, and then later to its governance, have pondered firstly about the novelty of the TCP/IP protocol suite (Abbatte, 2000; Leiner et al, 1997), involving detailed analysis and description on the conception, expansion and evolution of the entity comprising the Internet. Later when the Internet became the predominant approach to communications networks "Internet governance" as a concept and as a "discipline" and field of enquiry began to emerge. In this latter stage the new organizations and institutional normativity that emerged with this novel networking communications order have been cast as a response to the entity as such.

While boundary work in IG is more visible in specific institutional settings³, it is far less visible in the case of those practices performed by Internet companies at all levels. This boundary

³ E.g.: competitive and collaborative action of governments trying to enforce digital sovereignty nationally and internationally as well as competition and collaboration among technical standardisation organizations of all sorts.

work as an ensemble of practices that divide, (re)unite, assemble and re-define people, institutions and stakeholders around IG deserves greater attention as we contend that this is what is most radically affecting Internet governance scholarship and future Internet related policy.

Bearing in mind that the contest for the definition/redefinition of IG boundaries is multidimensional (legal and political, but also protocological, sociotechnical and, more importantly, epistemic), we contend and discuss that, due to the centrality of the Internet to the digital ecosystem at-large and due to the ubiquity of Internet-related technologies to contemporary life, "governance of the Internet", "governance on the Internet" and "governance with the Internet" have been increasingly treated ambiguously both in academic as well as in policy terms. As a way forward, we believe that those three things should be disentangled.

The *governance of the Internet* entails the core of this analysis, the definitional concern of the object and the idea of the Internet and how it is shaped by different forces, ideas and actors. This is the problem that we have been mainly addressing.

The second, *the governance on the Internet* addresses the governance issues that emerge due to the use of the Internet for a particular purpose. For example, cyber attacks that can bring down whole industries, or platforms; the creation of online fake campaigns that can steer the course of an election or a vaccination scheme during a pandemic; user-based models of knowledge generation such as Wikipedia, are all examples of uses of different layers of the Internet that have enormous impact on global and national governance schemes in the provision of public goods such as security, safety, knowledge and fair electoral processes, to name a few. The governance of platforms would fall under this category.

Finally, *governance with the Internet* refers to sociopolitical governance at-large in an interconnected world. This dimension addresses what can be accomplished by using this technology to address specific objectives by political communities - e.g.: the advancement of digital government, open source software, or the use of the Internet for the attainment of the Sustainable Development Goals - SGDs when examining the positive side. Darker purposes have been increasing and concern the use of the Internet for state surveillance, as well as to silence oppositional voices.

Let us go back to the issue of platform governance to illustrate the importance of being precise when referring to "Internet governance". As part of the overarching Internet governance agenda, platform governance has by and large obfuscated the original debates surrounding the governance of the Internet. Platforms allow the exercise of gatekeeping functions of the public domain as a widespread artifact (both technically and in its business model approach). Platforms exist due to their availability to erect boundaries and exercise gatekeeping functions to its services through technical, economic and normative measures. Platform governance is in itself a growing approach that seeks to understand technical systems and an appreciation for the inherently global arena within which these platform companies function. It also acknowledges the fundamental role of platforms as political actors and that these are subject to and informed by local, national, and supranational

mechanisms of governance. While Gorwa (2019) for example also adds the “global arena” in which platforms operate, there is a gap in the governance literature as well as in its practice as to how these global arrangements should look like and through which types of institutions, since platforms have been traditionally regulated by different types of “regimes” (copyright, child protection, freedom of expression, etc). As it becomes evident from a boundary perspective, these regimes are in fact defining the entity - that is the platform in question, but also the Internet in general - as these norms are embedded not only into the technical design and the terms and uses of these platforms, but also in the policies and regulations that are created to tackle Internet-related social problems (sic).

This move from a discussion related to the protocol layer to another one where the focus is on the content layer is significant for many reasons. In the first place, because platforms are mostly connected with private sector actors. This has consequences for their governance models, including the representation of different actors and approaches to multi-stakeholder governance, a vital institution (Raymond and DeNardis, 2015). In the second place, this shift underscores a governance dimension that focuses on the dilemmas that come with the use of the Internet, i.e. governance *with* the Internet approaches. While these issues are driving the agenda of Internet governance today, they were not as central in the original Internet governance agenda that was produced within the context of the concluding phase of the World Summit on the Information Society in 2005. (WSIS-05/TUNIS/DOC/6(Rev. 1)-E, 2005). In fact, despite the claims for an understanding of a global approach to the power of international tech companies, there are few examples of these kinds of global institutional approaches attracting different stakeholders. What are the implications of this shift towards a platform governance approach?

We contend that it is urgent to address ‘Internet governance’ as its boundaries are being moved by political, economic and technological forces. This attention on the concept and practice should not be seen as an attempt at fossilizing the Internet, but rather as an avenue for providing greater transparency and understanding on what concerns its principles - which are being disputed and reframed (governance *of* the Internet), its uses (governance *on* the Internet) and its wider social, political and economic affordances (governance *with* the Internet).

The cacophony surrounding Internet governance scholarship and policy is blurring one of the most fundamental metaphors of boundary work around Internet governance which is the notion of technical/ architectural layers that have structured different policy domains and issues around the Internet use. New boundary configurations have implications for policy makers as well as for scholars and users. As a consequence, understanding some of the effects of boundary work in Internet governance around how the layered approach and the E2E argument is configured and reconfigured is relevant for its policy, market and social implications.

vi. Final comments

In this work we have addressed Internet governance through the lens of boundary-work theory to nurture and improve the exercise of concept formation (Gerring, 2001) around a disputed notion. We have aimed to define the ontological aspects (Goertz, 2005) of the Internet but not as a reified object that shapes its contours, but using boundary theory we

have looked at how the context and its different technical, political, commercial and social forces have been defining and re-shaping it over the last decades. By examining the E2E principle we have addressed what is for us the most fundamental necessary condition for the Internet to be a particular type of entity. Yet, also embracing boundary theory it is the context that will be continually reshaping the entity and thence its governance problems and mechanisms.

The three prepositions used here (of, on and with) embrace different analytical aspects traditionally associated with the umbrella term "Internet governance". While we depart from the different semantics associated with each of them, we recognize that there are conflicts around the definitional boundaries of the field, as developed earlier, that will not be at all solved by a simple turn to linguistics. But conceptual formation is a fundamental exercise to inject precision and more value to these terms. It is relevant to inject more precision into the immateriality of the Internet as an artifact. Finally, this exercise has implications for policy and regulatory attempts which may have explicit or implicit approaches at exercising different boundary work on the Internet.

vii. References

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