Governing (Socio)Materialities at the Intersection of STS and Internet Governance: Hybridization as a Product of Necessity

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Abstract

In the last years, a rich literature has emerged at the intersection of Internet Governance as a field of study and Science and Technologies Studies. This *Scenario* retraces the complex social and technical historical developments that favored the integration of these two fields. This hybridization process can be described as a "product of necessity" – a descriptive label highlighting how the integration of STS concepts responded to evolving analytical challenges. It is delineated through a reconstruction in three phases, whose aim is to describe key intersections and to capture the ongoing trends within the Internet Governance community. The analysis shows that the first "turn to infrastructure" (Bowker et al. 2010) in the 2010s oriented scholarly interest towards materialities and protocols of the Internet as information infrastructure, thus favoring the study of its "control points" (Musiani et al. 2016). On the other hand, today's focus on geopolitical competition and informal governance practices provokes renewed interest in the social and situated components of the Internet infrastructure, such as imaginaries, contestations, and reappropriations. The *Scenario* finally discusses possible future approaches and research interests.

Keywords

internet governance; science & technology studies; digital geopolitics; information infrastructure; digital sovereignty.

1. Introduction

At first glance, the Internet is the perfect object of analysis for the toolbox offered by Science & Technology Studies (STS). It is a distributed system that has come to be imbricated with almost every human activity, and whose social integration makes it often disappear in the background, within the invisibility of taken-for-grantedness. In a word, the Internet is an infrastructure (Mongili and Bowker 2014). It would be fair to assume that Internet Governance (IG) – the research field that is specifically concerned with analyzing the Internet from any angle – configured itself as a branch of the larger Infrastructure Studies tradition.

Nevertheless, despite the convergence between IG and STS being extremely productive, it is a relatively recent phenomenon, being no more than 15 years old. What are the reasons for this lateness in the appropriation of STS by Internet governance studies?

This *Scenario* retraces the complex developments that have increasingly put STS and IG on the same track. It does so by entangling the changes of paradigm in the IG academic community within a broader scenario that accounts for the most significant technological innovations and sociopolitical events. The result is a reconstruction in three phases (Table 1), whose aim is to describe key developments and to capture the ongoing trends within the IG community to indicate possible future research directions and approaches. It is worth mentioning the difficulty – and sometimes the impossibility – of separating IG as a field of practice and IG as a field of study. While the former gathers those who are directly involved in the governance processes, the latter indicates the scholarly community concerned with analyzing the Internet and its governance. Such academic family took institutional shape during the 2006 GigaNet (Global Internet Governance Academic Network) and became increasingly wide and organized. While the present *Scenario* always refers to the community of study, it also seizes the opportunity to highlight how the IG research toolbox has been constantly reshaped by key events that affected the community of practice. A prominent example emerging in the analysis is the growing privatization of governance functions (community of practice) which set the stage for the infrastructural turn in IG-related research (community of study).

We show how the IG scholar community in its seminal stage was characterized by an institutional understanding of governance, focusing on the formal actions and processes undertaken within specific international venues, with the ICANN (Internet Corporation for Assigned Names and Numbers) playing a central role. The hybridization with STS came up in the early 2010s and can be described as a product of necessity. We use this term as a descriptive device underscoring the scholarly need to develop new analytical tools to decipher both the increasing privatization of the governance of the Internet (infrastructural turn) and the effect of the latest sociopolitical processes (social turn). Rather than a fully-fledged theoretical construct, the "product of necessity" helps capture how shifts in the Internet governance landscape prompted methodological adaptations among scholars. This concept also shows how changes and challenges affecting the community of practices rearranged the research toolbox of the community of study.

The infrastructural turn in IG was the recognition that a complex sociotechnical system such as the Internet is not only governed by institutional authorities, but by every actor that participates in its modular, distributed, and hybrid shaping. In a historical moment where the Internet is contested by a large variety of social formations (Badouard 2017), this recognition means opening Pandora's box, as it presumes the identification of each of these sociotechnical communities as performative – thus governing.

On this basis, we envisage a new theoretical and conceptual arrangement in today's IG that complements the infrastructural approach with renewed attention to informal acts of governance, enhanced geopolitical competition, and new public-private relationships. We argue that this approach represents the natural evolution of continued integration of STS and IG because it allows for accounting for the value of lay users, social movements, and invisible workers as governing subjects. This trend is well epitomized by the choice made by Uhlig

and colleagues (2021) to depart from the traditional OSI (Open Systems Interconnection)[1] layered representation of the Internet to propose a different model with a top "social" layer, thus accounting for the role played by states, companies, and lay users. It also constitutes a valuable analytical key to analyzing how existing power relationships unfold and materialize in a fragmented scenario of intense and continuous contestation over values and sovereignty.

The *Scenario* concludes by asking whether the conceptual enlargement of the governing subjects brought about by the STS scholarships, as well as the inclusion of other social sectors in the field of IG are provoking further boundary shifts in the discipline.

2. The Institutional Approach: The Birth of Internet Governance Among International Bodies

IG as a field of research saw the light during a process of conflict and stabilization over the transformation of the Internet into a mass public medium (Mueller and Badiei 2020). Its massification concerned the structuration of new governance solutions and ended up generating a class of international bodies responsible for regulating the Internet as a public medium. Before the '90s, the Internet was mainly a tool in the hands of the US military and a small, but growing, group of academic institutions[2]. As repeatedly narrated, it was the product of the American acceleration of scientific innovation undertaken under the Eisenhower Administration in the context of the Cold War (Abbate 2000). The Internet's development was funded by the Pentagon and coordinated by the ARPA (Advanced Research Projects Agency, now DARPA).

In that context, the Internet was expected to provide a distributed system of data storage and communication capable of outliving a Soviet nuclear assault. The achievement of this goal experienced a significant leap forward thanks to the creation of the TCP (Transmission Control Protocol) by Vinton Cerf and Robert Kahn in 1974, which became an official standard in 1980. While the protocol handled the segmentation of information into packets, the management of delivery functions was complemented by the Internet Protocol (IP), which assigns a unique numerical code to each network node. These codes are turned into human-readable names within the Domain Name System (DNS).

The process of massification of the Internet occurred in the '90s and was the result of a multiplicity of factors, such as the development of the World Wide Web in 1989-1993 and the publication of a freely available web browser software in 1991 (Schafer and Thierry 2018). However, the decisive process was the privatization of the Internet backbone undertaken by the Clinton Administration, officially culminating with the assignment of the administration of the DNS to a newly created nonprofit corporation based in California in 1998: the Internet Corporation for Assigned Names and Numbers (ICANN). The Internet stopped being a tool of the US military-industrial complex, as ICANN was incorporated under California law (Balbi and Magaudda 2018). Nevertheless, it kept decisive relations with the US government, which continued to exercise formal oversight. This outcome was subject to vocal contestation since the beginning (Froomkin 2000).

The American decision generated different responses from all over the world, and the resulting institutional debate represented the embryonic stage where IG as a field of study was

generated. In particular, countries of the BRICS (Brazil, Russia, India, China, South Africa), already existing international organizations such as the International Telecommunication Union (ITU), and, in the first stage, the European Union opposed the self-regulation principle as the rationale behind the incorporation of the ICANN. As outlined by Pohle and Santaniello, the US administration, corporations, and technical community were components of a "self-regulation" coalition, while the others were an "internationalist" one (2024). This controversy mainly occurred during the UN-hosted World Summit on the Information Society in Geneva (2003) and Tunis (2005) and mainly addressed the Internet's resources that ensure its technical functioning and who should have been entitled to their administration. Prominent resources were domain names, the root server system, and IP addresses. The result of this debate was the institutionalization of multistakeholderism as governing principle and hegemonic discourse (Santaniello 2021) and a standardized definition of IG as:

> the development and application by governments, the private sector, and civil society, in their respective roles, of shared principles, norms, rules, decision-making procedures, and programs that shape the evolution and use of the Internet. (WGIG 2005)

Both the multistakeholder model and the definition of IG can be seen as a compromise of the two conflicting positions (Malcolm 2008).

What resulted from this decade-long process was also the emergence of some non-national and non-binding institutional venues as the main *loci* where IG was to be practiced and the continuous, open, and neutral functioning of the Internet as the main goal. This played a major role in defining the field's objects of analysis, its conceptual toolbox, and the academic background of the first scholars who tackled it. The first relevant objects of analysis for those pioneer IG scholars were those very same international institutions and forums, often with a focus on the formation and stabilization of their internal structures (Kleinwächter 2004; 2006). Particularly significant works have analyzed their crystallization into institutionalized hegemonic discourses (Chenou 2014) and ideologies (Simpson 2004). The most analyzed institutional venues are the United Nations Internet Governance Forum (IGF), the ICANN, regional Internet registries (RIRs), and the organizations in charge of setting the logical and hardware standards of the Internet, e.g., the Internet Engineering Task Force (IETF) or the Institute of Electrical and Electronics Engineers (IEEE).

A second analytical dimension relates to the definition of the principles that drive these institutions' activities, such as openness and network neutrality. A special mention is to be made for the guiding principle of multistakeholderism, which has remained a relevant object of debate until today. Officially included in the IG language with the establishment of the Working Group on Internet Governance (WGIG) in 2003, it initially acquired a dogmatic status, as it prescribed the inclusion of governments, the private sector, and civil society in the governance processes. It was for this reason welcomed as the decentralized and bottom-up mode of governance that the Internet deserved (Doria 2014). Today, several contributions gained a more critical approach to multistakeholderism, often presented as fiction (Hofmann 2016), as a discursive tool to reproduce dominant power relationships (Palladino and Santaniello 2021), as an inconsistent institution (Raymond and DeNardis 2015), or as characterized by economic entry barriers (Cogburn 2006).

A third academic debate was preoccupied with the legal and jurisdictional consequences of the standardization of the Internet's protocols. Topics such as intellectual property, the circulation of illegal material (McIntyre 2010), and user surveillance (Mueller 2004) triggered a prolific debate over the relations between laws and digital technologies (Lessig 2000) and how states and governments could exert their legal authority (Goldsmith and Wu 2008).

It is worth noticing that, although the centrality of said international institutions is evident, it was already challenged by the need to include other objects and actors. Brousseau and colleagues, e.g., pointed out the difficulty of defining IG, and the need to address the strict relationship between technical and political communities, analyzing narratives and practices of developer and user communities (2012). In this context of the negotiation of the disciplinary boundaries and tools, the definition provided by Jeanette Hofmann of IG as a "regulative idea in flux" (2007) attracted particular interest. Hofmann assumes the institutional process of formation of a governance structure leaves a "regulatory void" that intertwines with the desire for more actors to be involved in the governance processes. For this reason, IG emerged as a field in continuous mutation.

3. The Infrastructural Turn in IG: A Product of Necessity

The opportunity to expand the boundaries of IG studies through the hybridization with much STS scholarship came with the increasing importance of the phenomena of privatization of the governance of the Internet (DeNardis 2012). In a way, private actors have always been central in the proper functioning of the Internet: they operate the wired and wireless technologies underlying the Internet, participate in standard-setting organizations, and develop the main applications that channel information across users. Nevertheless, as observed by DeNardis, their role in "determining freedom of expression and carrying out law enforcement functions" has heightened at the end of the 2000s. They have been increasingly coopted by nation-states to influence financial flows, carry out technical outages, and domain name seizures.

Those years were also characterized by the rise of an unprecedented kind of private actor: platforms. While traditional telecommunication companies played key roles, such as that of Internet Service Providers (ISPs), platforms such as Google and Amazon profited from their network power to grow as actual infrastructures (Plantin et al. 2018). Instead of developing as bare marketplaces or content operators, they created their own infrastructural capitals, e.g., data centers with storage space and computational power to sell, and submarine and terrestrial fiber optic cables developed in public-private consortiums (Starosielski 2015; Zájacz 2019). Private platforms became thus indispensable for the Internet to work – and in fact, they changed the way it works (Terranova 2022) – for other platforms to operate, and for national governments to enforce their laws.

On the academic side, these changes in the modes of governance required an analytical adjustment to be grasped. This is the context where the so-called "turn to infrastructure" took place as a product of necessity. This characterization should be understood descriptively, pointing to a pattern of adaptive integration rather than proposing a generalizable theoretical model: the political cooptation of private infrastructures provided a theoretical rearrangement

of the field based on the assumption that "material arrangements are power arrangements" (Musiani et al. 2016). Understanding these power arrangements implied reinforced attention to infrastructures as large collections of material necessary for human organization and activity. While this may be of little novelty for STS specialists, it led several IG scholars to reconsider the conceptual foundations of the field. While several works crossing STS tools and IG objects of research had already seen the light (e.g., Manovich 2001; Star and Bowker 2002), they received little attention because of dominant approaches in the field that were rooted in political and legal sciences. In the studies on the Internet, the infrastructures became particularly useful as "information infrastructures" (Bowker et al. 2010), implying enhanced attention not only on materialities, but also on the way information is constructed, treated, and conveyed. In the context of the Internet, this allowed us to conceptualize the protocols, repositories, and languages through which data are treated.

As infrastructures became the central object of concern for IG scholars, they also became the foundation for a new perspective, commonly referred to as the "infrastructural approach" (Starosielski and Parks 2015). In this first theoretical hybridization, the academic focus was mainly captured by the material components of infrastructures, regarded as the *locus* where politics unfolds. They were conceptualized as "control points" (DeNardis 2009) – technical components to harness to carry out political decisions. Of course, the reflection behind this concept was heavily influenced by the traditional STS literature on Actor-Network Theory and the agency of non-human actors as "mediators" (Latour 1992). Furthermore, since the focus on materiality was largely functional to understand the ways political entities were coopting it to pursue their ends, scholars were forced to cope with the complex intermingling of state and designers' agency. The analysis of how human actions unfold at a material level revealed the usefulness of the concept of "inscription" to highlight the situatedness of the human shaping of technology (Akrich 1992).

Another significant contribution of the STS scholarship is the attention developed by IG scholars for controversies (e.g., Haraway 2016). Although it was already present in many works adopting the institutional approach (e.g., Deibert and Crete-Nishihata 2012), the concept of controversy was deeply reconsidered and accepted as an analytically productive moment that allows for invisible infrastructural components to be noted, power relations to emerge, and the meaning-making systems of relevant social groups to be studied (van Eeten and Mueller 2013).

The centrality of controversies is also linked with the reconsideration of what governance is. In many STS-informed contributions, the salience of distributed and hybrid agency meant the necessity to ponder which acts are acts of governance. At this point, the governing institutions that were reified by political and legal scholarships started being imagined as "seemingly stable arrangements of IG arise from the chaos of taken for granted, mundane, and often apparently unrelated activities of Internet design, regulation, and use" (Epstein et al. 2016), just as "scientific order is constructed out of chaos" in scientific labs (Latour et al. 1979). Re-considering the situated construction of technology and assuming governance as coordination constituted a driver for deeper reflections on the notion of normativity. According to Musiani, IG is to be understood as a "normative system of systems", made up of discrete and hybrid agencies that intersect according to different value systems (2024). In her argument, the author draws on the concept of "ordering" proposed by John Law (1992) in the realm of the sociology of translation

(Latour 2005) to account for the unstable and ever-changing product of hybrid networks of actors, shifting narrative, and contrasting value systems. This concept has been also adopted in other similar works (Brousseau et al. 2012; Flyverbom 2010; Ziewitz and Pentzold 2014).

Such deep reassessments of normativity have been particularly useful in the study of standard-making and standard-setting. As the interest of IG studies in standardization processes was already strong with official standard-setting organizations (e.g., IETF, IEEE), the ground was breeding to include other actors and situated aims in the definition of standards. Insightful works have debated, e.g., the power dynamics underpinning standard-making processes (ten Oever and Milan 2022) the geopolitical use of standard-setting organizations (Nanni 2021), or the making of informal standards outside institutional venues (Ermoshina and Musiani 2019). Furthermore, other scholars tried to retrace the dynamics of these complex ordering processes through the STS concept of *black box*, i.e., intricate combinations of technical and non-technical changes, political discourses, sociotechnical imaginaries, and norms. This is the case in Pohle (2013; 2016), who used the concept to analyze institutional coordination issues from a discursive perspective, and in Fratini and Musiani, whose work highlights the performative nature of the imaginaries, discourses, and practices (de)legitimizing data localization measures (2024).

4. The Social Turn: Digital Sovereignty, Geopolitics, and Informal Governance

Today, the role of private actors in IG has become a given. However new global conditions have made new sociopolitical processes central among IG scholars. In particular, the multiplication of military conflicts, the regulatory activism of many governments (Flew 2024), and the unfolding of digital-related contestations around privacy, surveillance, and disinformation (Gros et al. 2017) have raised new academic questions, together with a renewed re-articulation of the hybridization of STS and IG and open debated about the boundaries of the field. We call this latest hybridization step a *social turn*, as it is characterized by the need to understand the effects that said social and political changes have on digital technologies and their governance. This phase is also shaped by the growing interest in and use of concepts related to imaginaries, discourse, and the performativity of informal governance practices.

The study of how states (or the EU) try to assert their control over digital infrastructures, the reasons for doing it, and the hybrid actors involved is usually categorized under the label of digital sovereignty (Couture and Toupin 2019; Fratini et al. 2024; Pohle and Thiel 2020) and involves deep attention for those regulatory and bureaucratic mechanisms that shape technology. A brilliant example among STS scholars is represented by the work of Brice Laurent on the EU infrastructural regulations (Laurent 2022). Among IG scholars, digital sovereignty has become a first-relevance topic just as multistakeholderism was. Pohle and Santaniello, e.g., talk about a new discursive order (2024), while Thumfart defines digital sovereignty as a new normative paradigm (2021). A relevant STS concept that started being adopted in this research strand is that of *sociotechnical imaginary* (Jasanoff and Kim 2015). Since governmental agencies and regulators around the world became proactive in reshaping technology, several authors investigated their expectations connected to the Internet and the digital (e.g., Monsees and Lambach 2022).

This concept has been also subject to re-elaboration and criticism. A remarkable example is the concept of *infrastructural ideology* proposed by Maxigas and ten Oever (2023) by expanding the work on *network ideologies* carried out by Bory (2020). The objective was to better highlight the power relationships that are produced and reproduced in the process of materialization of the discursive elements captured by the concept of sociotechnical imaginary.

The work on digital sovereignty is intimately connected with the rising geopolitical approaches to IG. Just as in the case of the turn to infrastructure, the geopoliticization of IG can be understood as a product of necessity related to the uses (and abuses) of the Internet infrastructure in times of war and enhanced interstate competition. A set of works in this regard is preoccupied with the analysis of the geographical dimension of the Internet from an infrastructural perspective in times of conflict. Some examples are provided by Fontugne and colleagues, who adopted an original approach combining network measurement and qualitative interviews to assess the degree of interdependence between Autonomous Systems (ASes) in Crimea after the Russian occupation (2020). Similarly, Salamatian and colleagues analyzed how Iran has been able to selectively cut off Internet traffic for geopolitical purposes by leveraging the Border Gateway Protocol (BGP), i.e., the protocol responsible for traffic routing between regional ASs (2021). Finally, ten Oever and colleagues used the same approach to assess the effect of European sanctions against Russia (ten Oever et al. 2024). This debate links with the longstanding argument around the possible fragmentation of the Internet (Drake et al. 2016; Mueller 2017), which some authors managed to handle through a more infrastructural perspective that accounted not only for materialities and state policy, but also for the agency of corporations, users, and civil society (Rossi et al. 2024).

A third prolific dimension relates to the effects of the scandals and contestations that burst in the 2010s around digital technologies and their use or misuse, e.g., in the case of the Snowden revelations or the Cambridge Analytica scandal. In the field of Critical Security Studies, Monsees delivers an important contribution to the contestation of surveillance

	Institutional Approach	***Infrastructural Approach***	***Social Approach***
Object	How IG is politically and legally understood and enacted	How IG is materially achieved through design choices and material leverages	How non-institutional actors negotiate and (de)legitimize IG
Actors	International and national public institutions and governments	Corporations, designers, technological artifacts	Users, social movements, collective actions, invisible workers
Theory	IG as a set of policies and strategies	IG as a material arrangement and design choices	IG as a hybrid black box

Table 1.
The three phases of Internet Governance.

technologies whose core thesis postulates the connection between modes of surveillance and modes of contestation (2020). According to the author, diffuse surveillance generates diffuse forms of contestation, with key technologies such as encryption becoming arenas of political struggle. The rising interest in cryptography can be observed in a variety of other works (e.g., Ermoshina and Musiani 2022; West 2022). The analysis of user agency also stimulates STS' proclivities for considering the situatedness of values that were initially analyzed only in institutional sites, e.g., privacy and openness. In this regard, Mager conducted an in-depth analysis of how search engine developers counter-imagine hegemonic search (Mager 2023) and Friedewald and colleagues observed the perception of surveillance, privacy, and security among different social groups in Europe (2017). This links with a flourishing interest in alternative and contestational technological production (e.g., Fratini 2024; Spencer and Pizio 2023).

In this phase, IG emerges as a hybrid black box itself, because the new historical conditions call for renewed academic interest in distributed practices of reappropriation, contestation, and informal governance in contexts of (geo)political conflicts.

5. The Debate on the Disciplinary Boundaries: A Further Enlargement?

This last phase shows an unprecedented interest in other components of the infrastructural perspective that received less attention in the previous phases. If the first "turn to infrastructure" was mainly animated by the interest in the material components and "control points" of the Internet infrastructure, the present moment is characterized by a beefed-up consideration for the discursive, imaginative, and practical dimension of Internet Governance. Multilayered contestations, regulatory domestications, and geopolitical frictions stimulate the reflection on the social construction and steering of technology. These processes investing the community of practice opens many debates in the IG as a field of study, e.g., over which actors are governing actors, with evident consequences on the disciplinary boundaries of IG.

An ongoing debate (even among STS-informed scholars) is related to the consideration of users – with their appropriations, subversions, or re-imagination – as governing actors, participating in distributed innovation and infrastructural maintenance. On the one hand, DeNardis contests this perspective, affirming that IG should be distinguished from user practices (2014). On the other hand, other authors argue for their inclusion (Musiani 2015), and the very Internet architecture is being rethought considering these new actors' relevance. Uhlig and colleagues, in a well-written explanation of how the Internet works, depart from the traditional OSI layered model used to illustrate the Internet infrastructure by connecting an additional top layer labeled as the "social layer", that also includes citizens and lay users (Uhlig et al. 2021). This conceptualization of user agency can open up new ways of assessing their governing capabilities (e.g., Fratini and Musiani 2024). This ongoing debate certainly highlights the extent to which multistakeholderism was influential in shaping the boundaries of IG through its tripartite inclusion of governments, the private sector, and civil society.

Finally, the inclusion of new governing actors, the attention to informal practices of governance, and the geopolitical-related salience of other sectors, such as the industrial one (e.g., chips' production), in the governance of the Internet stimulate the reconsideration of the

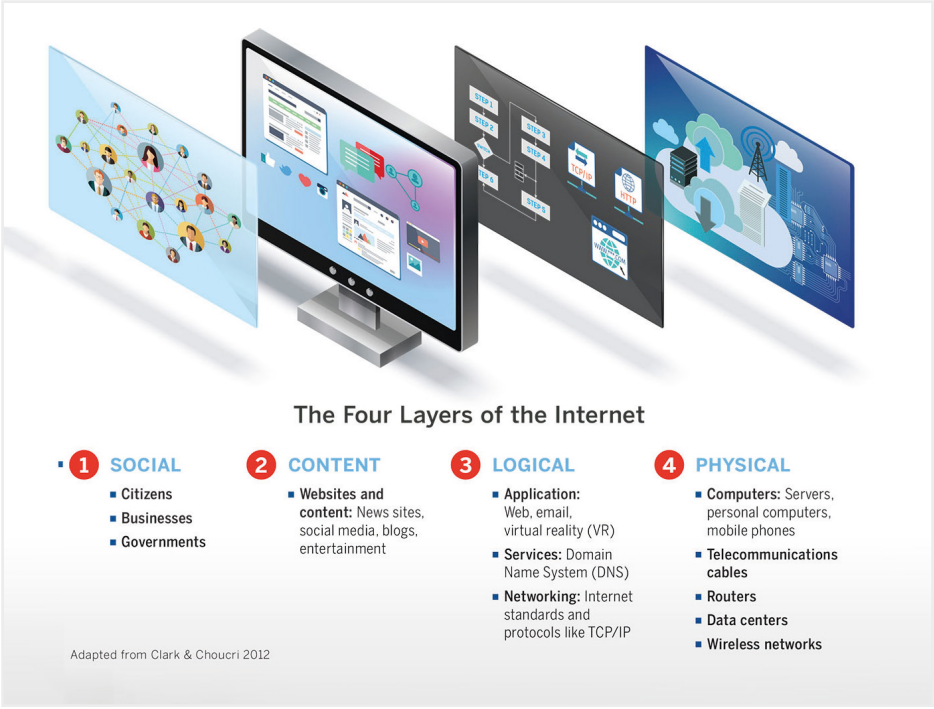

Figure 1.
Internet layered model that includes a social layer.

field boundaries. According to Mueller and Badiei, IG should be kept separate from other forms of governance, as it indicates an interest in the protocols and the principles governing the Internet's functioning (2020). Nevertheless, as DeNardis aptly notices, "there is no longer a logical demarcation between native digital companies and non-tech companies" (2020), which emphasizes the question of the convenience of distinguishing between digital and non-digital. Finally, the attention that several IG scholars have been increasingly devoting to other actors and fields is hard to deny, and the distinction between strict and broader Internet Governance is blurrier than ever. Due to the growing IG interest in the sum of societal fields gravitating around and shaping the Internet infrastructure, it is reasonable to expect further enlargements of the field's boundaries.

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Notes

[1] The open systems interconnection (OSI) model is a layered representation of the Internet whose clarity made it become a traditional means to explain how the Internet works. Available here: https://www.cloudflare.com/en-gb/learning/ddos/glossary/open-systems-interconnection-model-osi/.

[2] Even if there is an increasing amount of STS scholars producing thorough analyses of local, alternative, or failed versions of the Internet with an historical perspective (e.g., Schafer and Thierry 2017).

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