Insights from the Internet – How to Govern Outer Space

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Introduction

As the space domain grows more congested and complex, the need for robust governance frameworks becomes increasingly urgent. The challenges of managing orbital traffic, sharing critical space situational awareness (SSA) data, and fostering collaboration among a small but very diverse set of stakeholders—governments, industry, and civil society—mirror similar struggles faced by the Internet in its early days.[2] Many have pointed out the parallels between space and internet governance from legal and regulatory perspectives.[3]

Starting in the 1980s, internet governance evolved to manage the global, decentralized nature of a network that connects billions of devices, applications, and users. Multistakeholderism can be exemplified by organizations like the Internet Corporation for Assigned Names and Numbers (ICANN) and the Internet Engineering Task Force (IETF), which have created a constellation of global governance ecosystems that promote interoperability through technical standards, foster collaboration at fora events, and ensure that no single entity dominates decision-making through policy development. Similarly, the space community must

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1   New York University, United States.
2   Secure World Foundation, *Handbook for New Actors in Space*. Secure World Foundation, Broomfield, Colorado 2024. Available at: https://swfound.org/media/207931/handbook-for-new-space-actors_2024-revision.pdf (accessed: 25/02/2025).
3   J. Malcolm, The Space Law Analogy to Internet Governance, *SSRN Scholarly Paper*, Rochester, New York 2008. Available at: https://papers.ssrn.com/abstract=2798396 (accessed: 25/02/2025).

grapple with how to establish shared norms and practices that balance the interests of national governments, private operators, and other stakeholders.[4]

There is a growing number and diversity of actors in space, ranging from governments to private companies and end-users reliant on space-based data. There is an urgent need to address these challenges, for example, shared (or the lack of) SSA data nears a "tipping point" where collisions and congestion could become increasingly unmanageable without coordinated action. Rather than coming together, the SSA ecosystem is fragmenting as nations and companies develop independent systems that lack interoperability or shared standards.

The Internet governance model, while not perfect, offers valuable lessons for addressing these potential fragmentations. The Internet operates as a "network of networks," interconnected through shared protocols realistically only one: the Internet Protocol—and guided by governance structures that prioritize inclusivity and consensus-building but that are pluralistic and complex as a whole. By adopting similar principles and embracing complexity, the space community can work toward a sustainable governance model that seeks to ensure safety, transparency, and equity for all actors operating in orbit.

The following analysis explores how the principles of Internet governance can inform the development of space governance systems. It examines the successes and shortcomings of multistakeholder approaches in the Internet domain and considers their applicability to pressing issues in space, such as SSA data sharing, standardization, and the inclusion of diverse voices in decision-making. Ultimately, this author argues that the space community can leverage existing internet governance fora and processes to achieve consensus on select aspects of space governance that overlap with telecommunications, and at the same time it must take active steps to create a framework that ensures the long-term sustainability of the orbital environment by embracing the lessons of Internet governance.

Background

Internet operators connect billions of people and services through a set of shared protocols, the main one being TCP/IP, which enables seamless communication across networks through a narrow waistband of interoperability. Furthermore, it relies on decentralization and permissionless innovation enabled by two other crucial protocols: the Border Gateway Protocol (BGP) for lightweight global routing and the Domain Name System (DNS) for global identifiers. But the internet is far from simple in its construction, maintenance and growth: it is built upon consensus-driven governance to maintain its technical standards and operational stability.[5]

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4   M. Knodel, U. Uhlig, *How the Internet Really Works*, No Starch Press, San Francisco 2020. Available at: https://nostarch.com/how-internet-really-works (accessed: 25/02/2025).

5   *Ibidem*.

The key parallels between the internet and space are: global commons with decentralized actors, requirements for interoperability, data sharing, and governance; and the need to solve common hard problems of accountability and resource management.

Space and the internet diverge on the robustness of cooperation and governing documents. On the one hand, from engineers to CEOs there are millions of people working together to keep the internet running, and only a few governments and companies actively operating in space. On the other hand, there are no major treaties that underpin the global internet, and many people have considered the five space treaties[6] as definitive of space governance. However, there are new developments happening at the ITU where aspects of internet and telecommunications are also discussed. For example the ITU Radio Regulations (RR) advanced as recently as 2019 for non-geostationary satellite systems and in 2023 for company's jurisdictional requirements, together enabling the "new applications of radiocommunication technology while ensuring the efficient use of radio-frequency spectrum, i.e. the operation of as many systems as possible, without interference."[7]

From Cyberspace to Outer Space

Space governance can draw directly from the Internet's successes, particularly its emphasis on shared protocols, multistakeholder collaboration, and adaptive standards. However, these principles must be tailored to space's unique challenges, such as its physical constraints and the predictive nature of orbital management.

Protocols and standards

What does it mean to be on the internet? Surprisingly the only thing connecting us is the internet Protocol. Most other elements of any Internet service are left up to specific implementations, which are built upon norms and other protocols, but which can and do evolve over time.

It's helpful to visualize the Internet through the 'hourglass model.' At the bottom, you have hardware—things like satellites, undersea cables, and network cards. At the top, you have user-facing applications and platforms. The narrow middle, where TCP/IP exists, is the critical protocol that connects it all. This layer is key because it's both simple and universal. It allows any network—no matter how bespoke or localized—to connect to the broader Internet seamlessly.

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6   R.P. Rajagopalan, *The Outer Space Treaty: Overcoming Space Security Governance Challenges*, Council on Foreign Relations, Washington D.C. 2021.

7   ITU, *Non-Geostationary Satellite Systems*, New York 2021. Available at: https://www.itu.int:443/en/mediacentre/backgrounders/Pages/Non-geostationary-satellite-systems.aspx (accessed: 25/02/2025).

Governance builds out from this narrow protocol layer. Governance is about supporting technology innovation and use, addressing thorny issues that everyone has like spam or infrastructure replacement, and allowing diverse stakeholders—governments, companies, and even communities—to contribute to solving those problems. SSA standardization and other emerging technologies for satellite Internet constellations (SICs) are desperately needed and yet unattainable for largely non-technical reasons.[8]

Multistakeholder governance

Compliementary to technical specifications is defining the shared values, coming to consensus on norms and recognizing that the real asset for any global system is the robust network of people and their relationships to one another.

Multistakeholder governance ensures that those actively involved in building and operating systems also have a say in decision-making. For example, the IETF and ICANN work through open and inclusive processes. Anyone can join the IETF mailing lists or participate in meetings, which are fully open and free. ICANN, which oversees domain names and numbers, operates through contracts rather than ownership, ensuring accountability and interoperability.

This model recognizes that governments alone cannot address all challenges. In fact, some governments in the Global South have less capacity to engage in Internet governance than some nonprofit organizations or companies. Embracing the diversity of actors—from civil society to businesses—is key to solving complex problems.

Safety and accountability

Dealing with bad actors is a persistent challenge. On the Internet, we balance the principle of "connectivity at all costs" with efforts to curb spam and state-led censorship. For instance, multistakeholder organizations like the Messaging, Malware and Mobile Anti-Abuse Working Group (M3AAWG) address spam, while diplomatic efforts counter state interference. The Certificate Authorities (CA) collectively ensure trust and accountability in the web through shared principles.

At the same time, space governance faces its own unique challenges, such as the predictive nature of space traffic management and the need for real-time, accurate data.

Standards and best practices are essential, but the key insight is to identify what should be standardized and how as a matter of priority. While stakeholders

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8   J. Leiken, Satellite internet and laser links: Are universal FSO standards needed?, *New York University Journal of Legislation and Public Policy*, 2024, 26, p. 1165.

might operate differently, collaboration—across governments, companies, and other actors—creates stronger systems. For instance, in the Internet world, even small community-driven networks can connect globally using universal protocols. Space governance could adopt similar principles to manage the growing number of actors and ensure shared accountability. Prioritizing an issue like safety in space can help to focus stakeholders and strengthen the consensus-building process in early stages.

Transparency and equity

There are major milestones in Internet governance that can offer valuable insights for space sustainability. The transition of ICANN from U.S. government control to a global multistakeholder process shows how shared governance can work, but that if possible this sort of transition moment can be avoided entirely.

The lesson for space governance is the importance of fostering cooperation. While enforcement is difficult, building consensus and adopting shared standards helps mitigate the risks of bad behavior. Ultimately, inclusivity and collaboration within a truly multistakeholder governance process make systems more resilient.

Discussion

One of the critical lessons from internet governance is the power of norms and standards. In the absence of formal treaties, the Internet community has developed consensus-driven processes to create guidelines and technical standards that ensure interoperability, security, and access. These norms have helped to balance competing interests while preserving the Internet as a global public good. Similarly, space governance needs to embrace norm-setting as a way to manage the responsible and equitable use of space, particularly as private actors increasingly dominate the field.

Another parallel lies in the challenges of access and security. Just as we've grappled with issues of digital inclusion and cybersecurity, space governance must address questions about who gets to use space, how resources are allocated, and how we prevent monopolistic control. Left unchecked, the commercialization of space could lead to outcomes that serve the few at the expense of the many, much like the consolidation of power we've seen among a handful of internet platforms.

Perhaps one area with sharp departure from internet governance is the potential for kinetic and other real-world conflict, intentional or accidental, in space. Much of the scholarship related to space law is concerned with the "final frontier" for military action. "[G]rey zone conflict in outer space is closely linked to a persistent

failure to adequately govern peaceful space activities."[9] The role of space Internet in connected warfare and algorithmically driven weapons, an area where Internet governance is not sufficiently covered by expertise or binding agreements.[10]

The governance models that have enabled the internet to thrive—though not without flaws—offer a valuable blueprint for space governance. However, it is not enough to simply replicate these models; they must be adapted to the unique context of space. This includes recognizing the different technological, legal, and political landscapes, as well as the fact that space, unlike the internet, is a physical frontier with finite resources.[11]

Practically, what should be of priority for states and companies investing in space:

1. Leverage existing paradigms of international collaboration where there exists technology crossover, such as internet and telecommunications as well as the International Space Station.
2. Choose the minimum viable protocols for ground truth and governance (like GPS, BGP routing, and CAs), treat them as public interest goods and collaborate to ensure their collective governance, such as SSA and SIC standards.

These expert communities need an iterative, consensus-driven approach to space governance, one that builds on the principles of openness, inclusivity, and accountability. By involving a broad range of stakeholders and fostering a culture of collaboration, we can ensure that space remains a resource for all humanity, not just those with the most power or capital.

Recommendations

A succinct list of recommendations from the analysis and discussion that are based on decades of internet governance include:

- Establish shared values such as rule of law, economic systems, human rights.
- Rather than new treaties, focus on shared work and building consensus on technical standards that are sensitive to equitable governance among stakeholders.
- Identify existing standards overlap with telecommunications, such as GPS, DTN, satellite Internet delivery and work on those standards within fora that are already multistakeholder, such as the IETF, or have the potential to be, such as the ITU with Observer Memberships or the Consultative Committee for Space Data Systems (CCSDS).

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9   J. West, J. Miller, *Grey Zones in Space Governance. Clearing the Fog*, Centre for International Governance Innovation, Washington D.C. 2023.

10 M. Knodel, *Comments to the United Nations on the Global Digital Compact*, Center for Democracy and Technology, Washington D.C. 2024. Available at: https://cdt.org/insights/comments-to-the-united-nations-on-the-global-digital-compact/ (accessed: 25/02/2025).

11 L. DeNardis, *Interplanetary Internet Governance*, CIGI Paper No. 277, Center for International Governance Innovation, Washington D.C. 2023. Available at: https://www.cigionline.org/publications/interplanetary-internet-governance/ (accessed: 25/02/2025).

- Ensure new standard protocols are safety minded: The architecture that is maximally interoperable needs to be permissionless, such as SSA and SICs.
- Identify and protect public goods, like GPS, through proper governance.
- Make the case for an initial focus on safety, including issues affected by war and disaster.
- Equitable governance means a willingness to hold companies accountable.
- Address what isn't working in the current structure head on: First come first served is colonialist. There aren't enough incentives among powerful states to cooperate. Without standards there is no ground truth.[12]

In conclusion, the nascent field of space governance can—and should—draw heavily from the lessons learned in internet governance. There are strong parallels between the challenges in managing the global internet and those now surfacing in the governance of outer space.[13] The stakes are high, and the opportunity to shape the governance of the space frontier should not be taken in earnest. Together we can leverage the existing governance framework of the internet as well as create a new space governance framework, both of which should reflect our shared values and aspirations for the future of humanity.

Bibliography

Davis, N., End 'colonial' approach to space exploration, scientists urge, *The Guardian*, 4 March 2023. Available at: https://www.theguardian.com/science/2023/mar/04/end-colonial-approach-to-space-exploration-scientists-urge (accessed: 25/02/2025).

DeNardis, L., *Interplanetary internet governance*, CIGI Paper No. 277, Center for International Governance Innovation, Washington D.C 2023. Available at: https://www.cigionline.org/publications/interplanetary-internet-governance/ (accessed: 25/02/2025).

International Telecommunication Union (ITU), *Non-geostationary satellite systems*, ITU, 2021. Available at: https://www.itu.int:443/en/mediacentre/backgrounders/Pages/Non-geostationary-satellite-systems.aspx (accessed: 25/02/2025).

Kennedy, B., **Tyson, A.**, *Americans' views of space: U.S. role, NASA priorities and impact of private companies*, Pew Research Center 2023. Available at: https://www.pewresearch.org/science/2023/07/20/americans-views-of-space-u-s-role-nasa-priorities-and-impact-of-private-companies/ (accessed: 25/02/2025).

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12 N. Davis, End 'colonial' approach to space exploration, scientists urge, *The Guardian*, 4 March 2023. Available at: https://www.theguardian.com/science/2023/mar/04/end-colonial-approach-to-space-exploration-scientists-urge (accessed: 25/02/2025).

13 Secure World Foundation, *5th Space Sustainability Summit in New York City*. Secure World Foundation, New York 2023. Available at: https://swfound.org/events/2023/5th-space-sustainability-summit-in-new-york-city (accessed: 25/02/2025).

Knodel, M., Comments to the United Nations on the global digital compact. *Center for Democracy and Technology*, Washington D.C. 2024. Available at: https://cdt.org/insights/comments-to-the-united-nations-on-the-global-digital-compact/ (accessed: 25/02/2025).

Knodel, M., **Uhlig, U.**, *How the Internet Really Works*, No Starch Press, San Francisco 2020. Available at: https://nostarch.com/how-internet-really-works (accessed: 25/02/2025).

Leiken, J., Satellite internet and laser links: Are universal FSO standards needed?, *New York University Journal of Legislation and Public Policy*, 2024, 26, p. 1165.

Malcolm, J., The space law analogy to internet governance, *SSRN Scholarly Paper*, Rochester, New York 2008. Available at: https://papers.ssrn.com/abstract=2798396 (accessed: 25/02/2025).

Rajagopalan, R.P., *The Outer Space Treaty: Overcoming space security governance challenges*, Council on Foreign Relations, Washington D.C. 2021.

Secure World Foundation, *5th space sustainability summit in New York City*, Secure World Foundation 2023. Available at: https://swfound.org/events/2023/5th-space-sustainability-summit-in-new-york-city (accessed: 25/02/2025).

Secure World Foundation, *Handbook for new actors in space*. Secure World Foundation 2024. Available at: https://swfound.org/media/207931/handbook-for-new-space-actors_2024-revision.pdf (accessed: 25/02/2025).

West, J., **Miller, J.**, *Grey zones in space governance: Clearing the fog*. Centre for International Governance Innovation, Washington D.C. 2023.