Perspectives on LEO Satellites
Using Low Earth Orbit Satellites for Internet Access

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NOTE: This is a draft document for review by the Internet Society community. This is not a final statement or position. We welcome constructive feedback. Please send any comments no later than 4 July 2022 to leo-comments@isoc.org

For nearly one third of the world, on every continent, in rural, remote, and even urban communities, each day without Internet access is a day of lost opportunity. Through our global community, the Internet Society empowers and supports people to bring the Internet to everyone. We work to reduce barriers to access, and to make it reliable, faster and cheaper. Together, we don't just build and maintain connections—we advocate for the right policies so that the Internet can grow.

We see considerable potential in the use of low earth orbit (LEO) satellites for Internet access for unserved or under-served communities, especially where other ways of delivering Internet access are not viable. We also see potential for LEO-based systems to provide another way to deliver Internet access to communities affected by natural or human disaster and to increase the overall resilience of Internet connectivity. But, we also see serious concerns and, as of mid-2022, there are still many unknowns.

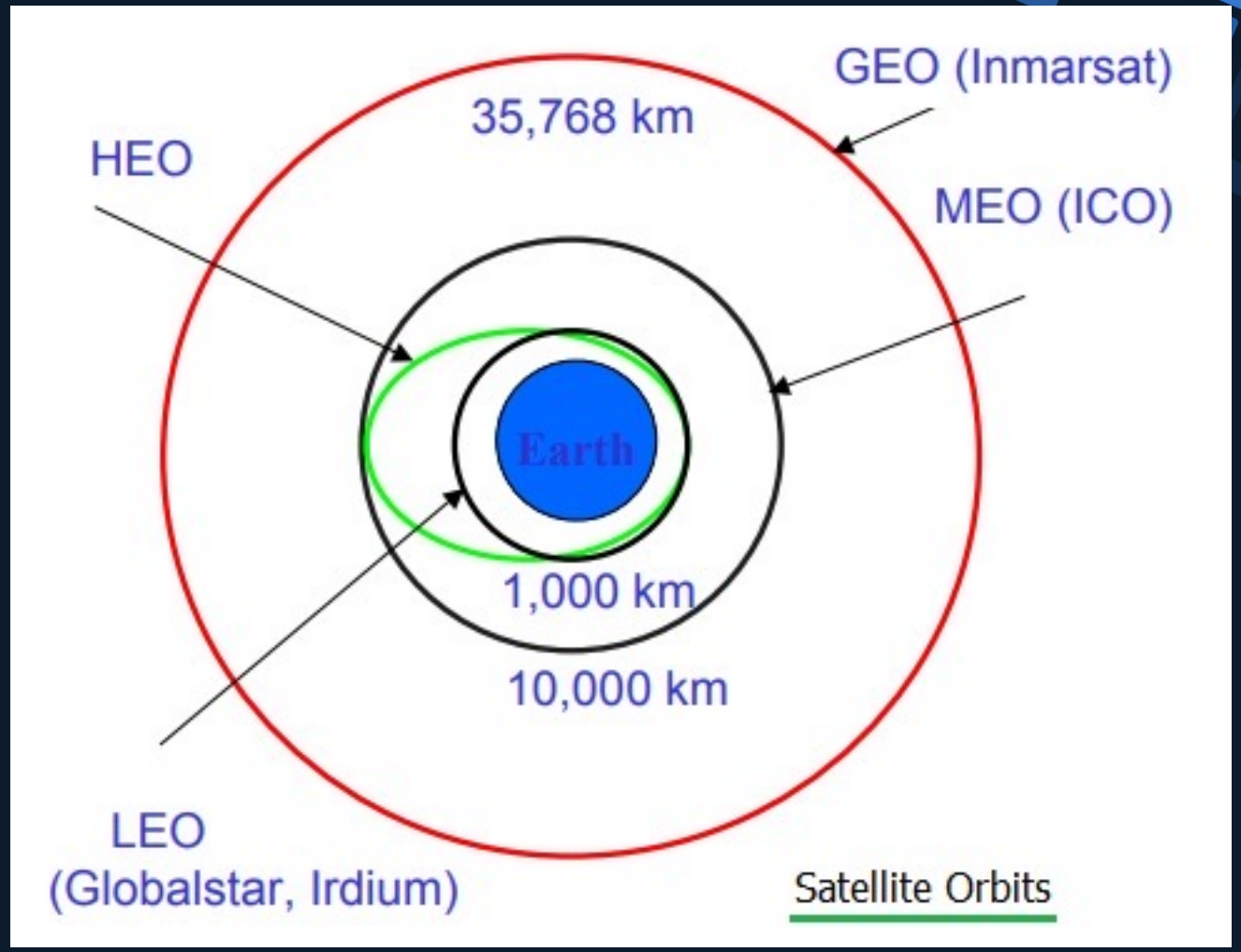
As the LEO-based industry matures over the next few years, there is an opportunity to guide the discussion and shape the future of this new form of Internet access. This document outlines opportunities, concerns, and questions for LEO providers, other Internet access providers, policymakers, researchers, journalists, civil society, consumers, and our Internet Society community.

Low Earth Orbit (LEO) Satellites and Internet Access

For many years, Internet access has been available from "geostationary"[1] (GEO or GSO) satellites operated by companies such as Eutelsat, Hughes, Inmarsat, Viasat and many others. These systems are an option for Internet access to regions that lack other connectivity. GEO satellites are typically the size

[1] For information regarding GEOs, see https://www.esa.int/Education/3._The_geostationary_orbit and https://www.sciencedirect.com/topics/earth-and-planetary-sciences/geostationary-satellite. For the difference between a geostationary and a geosynchronous orbit, see https://www.scienceabc.com/nature/universe/what-is-a-geosynchronous-satellite-and-how-is-it-different-from-a-geostationary-satellite.html

Low Earth Orbit (LEO) Satellites and Internet Access



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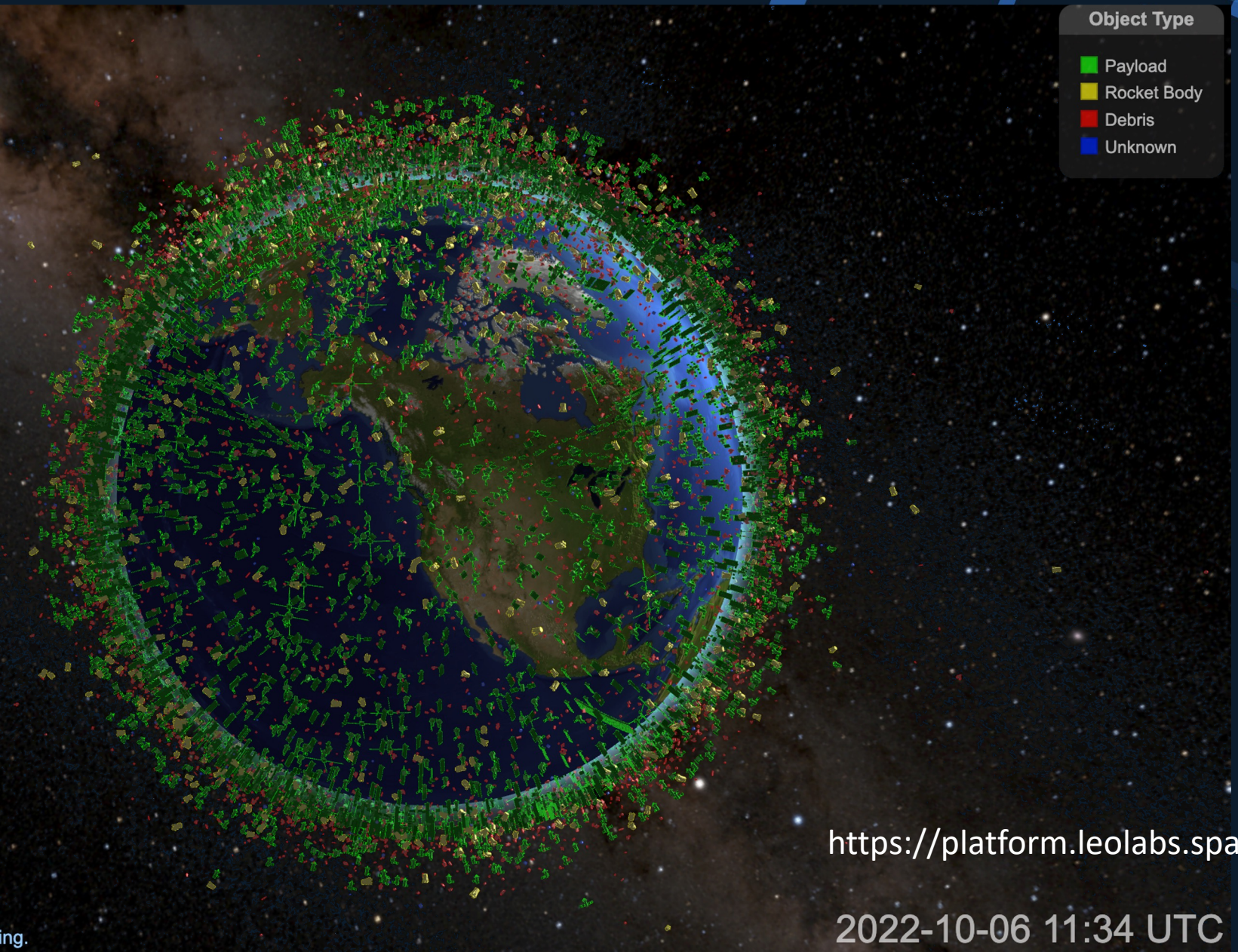

https://platform.leolabs.space/visualization

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The Opportunities

- Individual consumers
- Community centers
- Community networks
- High availability and network resilience

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Concerns

Affordability

Competition and Consolidation

Emergency deployment

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Policy

Geographic restrictions (geo-locking)
Geopolitics of low earth orbit access
Regulation of orbits and spectrum
Space debris
Spectrum allocation

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Technology

Availability and interference

Capacity

Interoperability

Open Standards

Privacy

Security

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Unknowns

Overall market

Sustainable business models

Impact on ground-based Internet service providers

Space weather

Externalities, subsidies and the true cost of service

Environment

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Analysis - IWN

Critical Properties of IWN Impact	
1: An Accessible Infrastructure with a Common Protocol that is open and has low barriers to entry	Uncertain. As highlighted above, affordability remains a concern, and it is not yet known whether all systems will support the common protocols used by the open Internet.
2: Open Architecture of Interoperable and Reusable Building Blocks based on open standards development processes voluntarily adopted by a user community	Uncertain. For example, IPv6 support is not yet consistently available in the only relatively large-scale LEO system in operation (Starlink).
3: Decentralized Management and a Single Distributed Routing System which is scalable and agile	Neutral or uncertain. So far, LEO providers have indicated that routing would work across their networks, as it does across any other Internet access network. However, with limited deployment this can not yet be verified.
4: Common Global Identifiers which are unambiguous and universal	Neutral or uncertain. DNS appears to operate across LEO providers as it does across other networks. Again, with limited deployment, results cannot yet be verified.
5: A Technology Neutral, General-Purpose Network which is simple and adaptable	Uncertain. We need further deployment of multiple systems to understand if they will act similarly to ground-based networks.

Enablers of an open, globally connected, secure, and trustworthy Internet	Impact
Easy and unrestricted access	Uncertain. Affordability is a concern.
Unrestricted use and deployment of Internet technologies	Uncertain. Deployment is too limited.
Collaborative development, management, and governance	Negative or uncertain. So far, all LEO systems are being built by commercial companies using proprietary systems. While they may be using open Internet protocols, there may be little transparency into the development and operations of their systems.
Unrestricted reachability	Uncertain. It is not yet clear if LEO systems operators will implement the ability to block content or resources. They may need to be able to do so to operate within some countries.
Available capacity	Positive. The growth and deployment of LEO systems should increase the overall capacity of the Internet and enable more connections by more people. This is provided they do not cause reduced investment in ground-based services that could more efficiently and sustainably provide Internet access in the medium to longer term.

Data confidentiality of information, devices, and applications	Uncertain due to limited deployment.
Integrity of information, applications, and services	Uncertain due to limited deployment.
Reliability, resilience, and availability	Positive or uncertain. We see potential for LEO systems to increase the overall resilience and reliability of the Internet. However, until there is more deployment, this cannot be tested or verified.
Accountability	Negative or uncertain. LEO systems are currently being deployed by commercial companies with limited requirements for accountability or transparency. The LEO providers may become de facto authorities and gatekeepers.

Privacy Uncertain due to limited deployment.

Thank you.

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