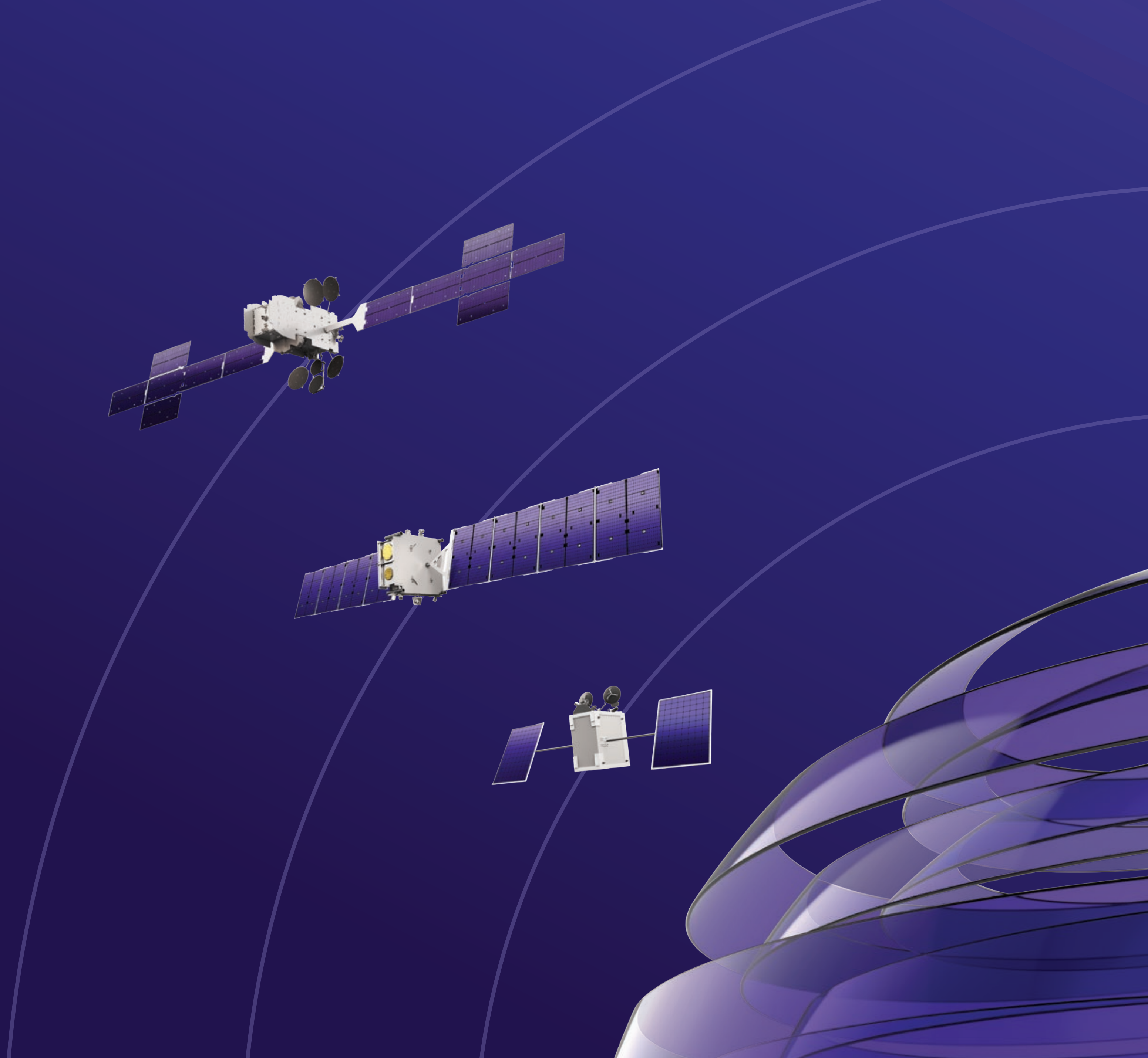
INSIGHT PAPER

When Does Orbit Matter?

How orbit and network architecture shape performance and application outcomes.



A satellite's orbit is one of several architectural factors that influence the ability to address networking requirements and successfully enable customer use cases. Space solutions are best evaluated by how well they serve user applications and their impact on business outcomes.

As one architectural characteristic among several, the relevance of orbit is context dependent: it matters in how it affects application performance and fitness-to-purpose as a component of an end-to-end network.

Orbital Altitude
Propagation Delay

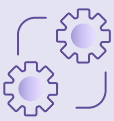
The physical distance between the satellite and Earth determines the base “lag” or ground-to-space delay.

Constellation Design
Handover Frequency & Total Delay

The number of satellites and their movement patterns dictate how often a signal must switch satellites, impacting overall stability.

Ground Infrastructure
Routing Efficiency & Control

The placement of gateways and physical hardware determines how directly and effectively data moves across the network.



Resource Management
Performance Assurance

Network design will determine if throughput is guaranteed (Committed Information Rate) or if it fluctuates based on how many other users are online.

How system design drives performance

Satellite connectivity services have become more mainstream, and their technology and acronyms are now part of common networking discussions. Satellite orbits—GEO (geostationary orbit), MEO (medium-Earth orbit), and LEO (low-Earth orbit)—are often used as shorthand to describe entire classes of service.

In operational environments, their practical importance lies in how they influence network behavior and application reliability. Stability, predictability, and the ability to support service commitments often have a greater impact on user experience than peak throughput or minimum latency.

Network behaviors emerge from the overall space system design including these components:

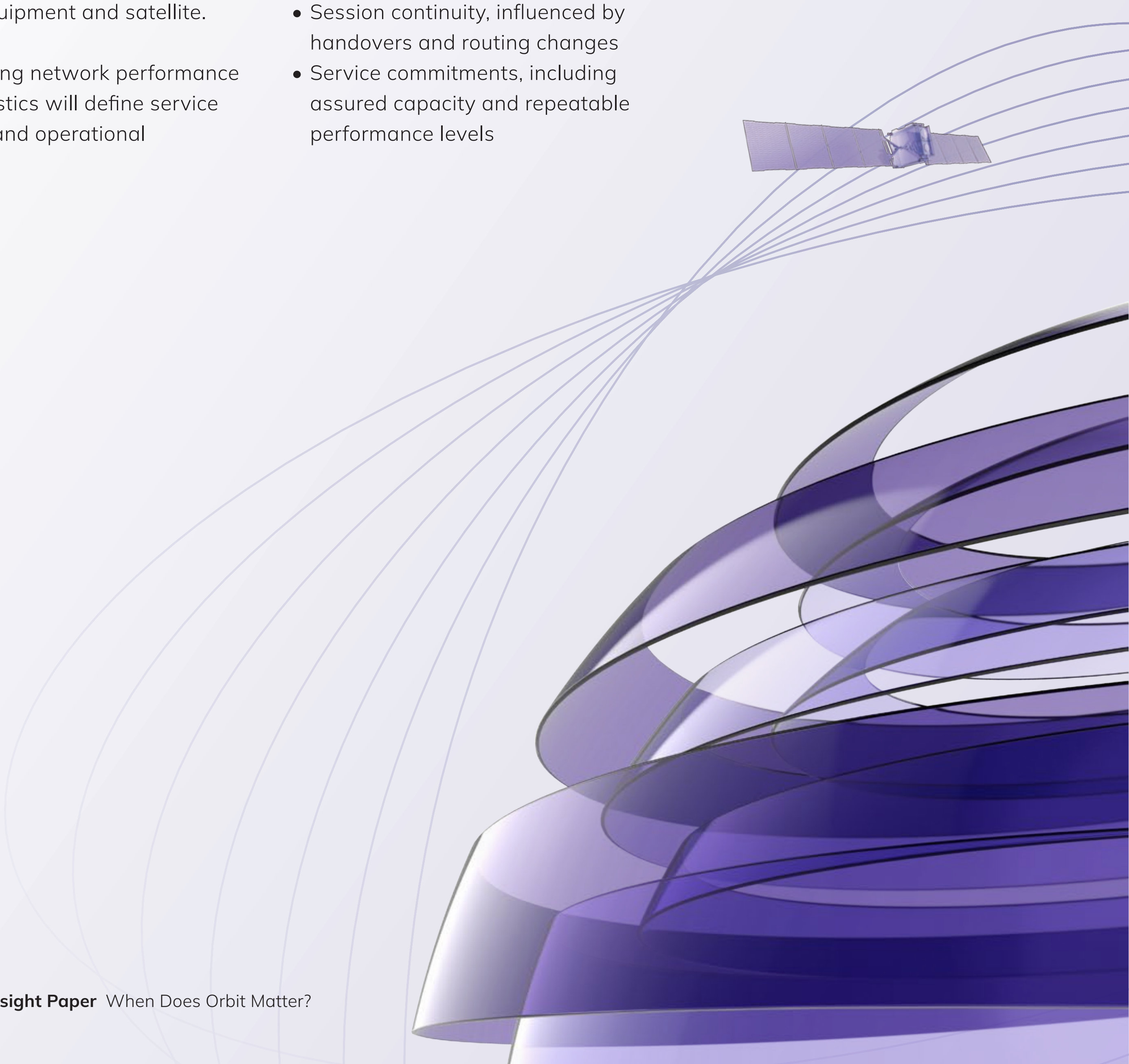
- Orbital altitude
- Frequency of traffic handover between network components
- Ground infrastructure placement
- Resource management

Performance implications of different orbits

Orbital altitude influences the overall design of a satellite network, including the number of satellites needed to deliver service, the type of ground equipment and antennas that can be used, and the consistency of the resulting signal transmitted between ground equipment and satellite.

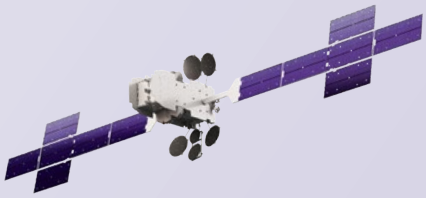
The resulting network performance characteristics will define service reliability and operational outcomes, with impacts on service metrics including:

- Latency predictability, which affects session stability and timing of sensitive workflows
- Jitter, which can degrade real-time applications and complicate performance assurance
- Session continuity, influenced by handovers and routing changes
- Service commitments, including assured capacity and repeatable performance levels



Here's a look at characteristics of three common orbits and the parts they play in a multi-orbit portfolio.

Geostationary Orbit (GEO)



Geostationary satellites have enabled commercial communications services for several decades, providing continuous coverage over very large geographic areas.

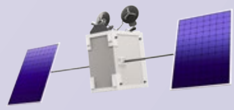
GEO satellites orbit in sync with the rotation of the Earth. Their fixed position in the sky enables stable point-to-point and point-to-multipoint service delivery and simplifies certain aspects of network coordination.

GEO architectures are well suited to services that emphasize coverage, distribution efficiency, reliability, and scale. Although known for a higher propagation delay, GEO services are often valued for their stability and consistency of performance.

Predictable Versus Minimal Latency

Depending on network and application requirements, the need for high service predictability and low jitter is more valuable than achieving the lowest possible latency. Latency variability and jitter caused by frequent path changes can disrupt sessions, create instability, and make performance issues harder to diagnose. Architectures that prioritize stable latency and fewer transitions can simplify network operations and support better service assurance.

Low-Earth Orbit (LEO)



The availability of LEO services in the last several years has driven renewed interest in space-based communications, as well as new expectations of ease-of-use and throughput of satellite services.

LEO propagation delay is considerably lower due to the satellite's closer proximity to Earth's surface. This enables very low one-way latency which may be needed for real-time systems like high-frequency trading or true remote robotics.

Being closer to the Earth's surface, LEOs must travel much faster than GEOs to maintain their orbit. Combined with the relatively small coverage provided by a given LEO satellite, LEO services rely on dense constellations of satellites and ground stations to provide continuous service. The service to a LEO ground terminal (antenna) is delivered by many different satellites over time, which may introduce latency variability when service is handed over from satellite to satellite as they move into and out of range of the terminal.

Additional delay and delay variability may also be introduced as traffic is passed between satellites on its way to gateways connected to terrestrial networks. LEO services are well suited to latency-driven requirements where jitter and variability can be absorbed at the application or transport layer.

Medium-Earth Orbit (MEO)

Although less visible in public discussion, MEO is positioned as a middle ground with service characteristics that align closely with enterprise and carrier operational requirements, particularly where performance must be repeatable, measurable, and sustained over time.

MEO satellites operate at intermediate altitudes (closer to Earth than GEO, further from Earth than LEO). MEO reduces propagation delay compared to GEO, delivering latency closer to LEO-based services. At the same time, its broader satellite coverage requires fewer ground stations than LEO, reducing handovers and minimizing multi-hop impacts on application performance. Wider MEO coverage footprints may also enable more flexible gateway access—traffic may be landed at fewer ground gateways without the need for inter-satellite links.

MEO services are well suited for applications and user experiences that demand more predictable round-trip latency, lower jitter, and improved session stability.

SES MEO is space infrastructure engineered to deliver guaranteed throughput for sustained, bi-directional traffic

In addition to predictable round-trip latency and reduced handover frequency, the design of SES MEO enables substantially higher return path throughput than is typical of many LEO services, and supports the allocation of committed information rates (CIR) that guarantee minimum performance levels. These capabilities allow services to be delivered with contractual SLAs rather than on a purely best-effort basis.

Together, the higher uplink capacity, assured throughput, and predictable network behavior of SES MEO support heavy cloud usage and applications that depend on sustained, bi-directional traffic and measurable performance outcomes.

When does orbit matter?

Orbit matters when it materially influences service behavior, enabling or constraining the delivery of defined service characteristics and the achievement of business outcomes reliably and at scale. When evaluating space services, the ability to meet enterprise expectations and achieve desired outcomes will typically be a more important consideration than the altitude of a given satellite.

Effective satellite service implementations leverage solutions that align with specific application requirements that best serve an organization's operational and business goals.

Solve.
Empower.
Soar.

Learn more about our purpose-built satellite and connectivity solutions at ses.com

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