CALIAN®
Confidence. Engineered.

EarthMesh™

Scalable modelling solution for advanced satellite communication

Calian's EarthMesh™ platform empowers space agencies, satellite operators and terrestrial operators to model, analyze and optimize the use of communication links in multi-orbit, multi-constellation environments. This scalable platform is designed to address the complexities of the burgeoning growth of satellites in space.

EarthMesh is an elastic computational engine that models and analyzes extensive and dynamic networks of space and ground-based assets over time and space. It empowers space agencies and satellite operators to plan and manage their missions and operations efficiently, optimizing RF communications.

Faster data analytics

Integrating EarthMesh into your solution provides rapid data and insights into system performance like never before. Our near-real-time calculations with large data sets empower informed decision-making and autonomous management. As mega constellations and multi-orbit configurations become the norm, EarthMesh is prepared to scale your analysis requirements to meet these challenges.

Increased resolution

A parallel solution that computes data across thousands of points per operation enables high resolution computations. This improves fidelity and decision making as beams become more focused and links become more dynamic. EarthMesh supports variable spatial and temporal resolution to best fit the needs of your requirements. Regions of interest can have increased resolution over the global simulation to further increase the value of data outputs.

Multi-orbit projection of a single NADIR beam for TDRS 3 and 100 Starlink Satellites (8ms per timestep)

Fully customizable

As a general-purpose engine, EarthMesh is highly configurable to meet the needs of your system and scenario. It supports detailed configurations for ground stations, spectrum and channelization, antenna patterns, beam count, satellite orbit parameters, and pointing modes. This flexibility enables wide-ranging applications and ensures readiness for new systems.

Big data ready

Computing on a discrete global grid allows fast analytics across all points of interest. The same points are shared across computations allowing for easily indexed and filtered data to pinpoint underperforming, underutilized, vulnerable and overallocated segments of the system. Framing geospatial problems using a discrete grid system enables vectorization and optimization of underlying computations.

LEO constellation coverage analysis

Flexible deployment

Designed to support both cloud and on-prem installations, EarthMesh easily integrates into secure on-prem solutions or the latest virtualized platforms.

EarthMesh is an elastic engine that enables dynamic scaling of performance. This enhances the ability to scale up as the timeframe grows from days to years, permutations expand from a single set to thousands, temporal resolution increases from minutes to milliseconds and scope of computations expands as more metrics are considered. When included as part of a cohesive system, the performance can scale based on the number of requests made to the engine. Coupled with a virtualized autoscaling policy this can ensure critical events maintain the performance required.

Interfaces

EarthMesh supports REST interfaces for external setup and control of simulations. Custom interfaces can be developed to integrate with your environment.

1. Measured on a workstation using a RYZEN 7700X and RTX 4090

Modelling capabilities

When deployed as a standalone simulation engine, EarthMesh models the ecosystem of variables to produce valuable data insights:

Orbit propagations	• Keplerian • TLE Set • Eckstein-Hechler • Simplified general perturbations
Satellite pointing	• Nadir • Targeted pointing
Ground station	• Fixed • Tracking • Operational schedules
Contacts	• Opportunities • Look angles • Contact selection
Beams	• Multiple beams per satellite
Multiple constellation interference	

Performance

EarthMesh completes interference analysis spanning 2 years on a constellation of 1000 LEO satellites with 2370 beams projected across 384 grounds stations in under 10 hours[1]. This represents over 1–million time instances with over 2.5–billion beam projections completed in that timeframe.

Calculation capabilities

As a general purpose engine, EarthMesh has capabilities to integrate a wide variety of computations that can benefit from the parallel compute engine. The set of highly optimized geospatial link budget calculations currently includes:

- Carrier and interference power
- Doppler shift
- Channelization
- Spectrum flux density
- Effective Isotropic Radiated Power (EIRP)
- Antenna gain to noise temperature (G/T)
- Free space loss (ITU-R P.525–4)
- Atmospheric attenuation (ITU-R P. 676–10)

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