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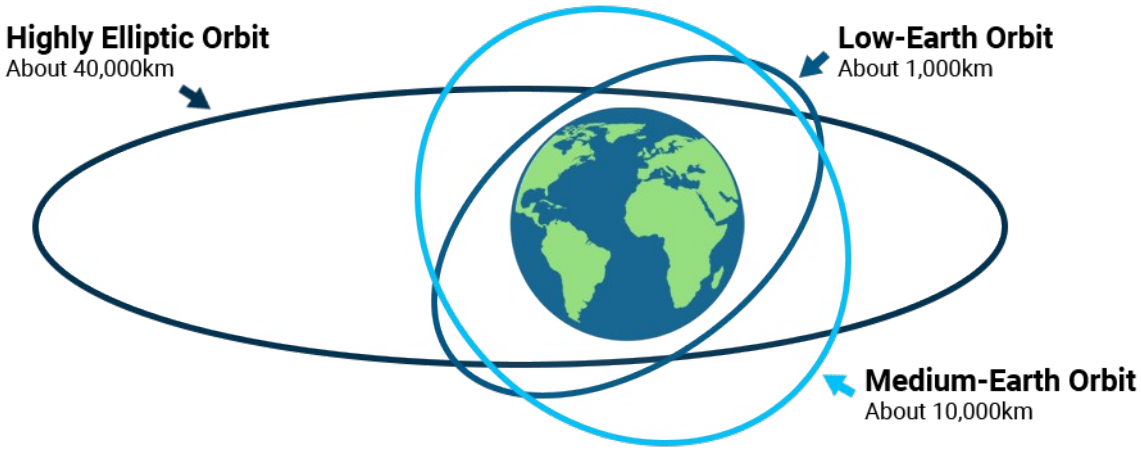
Low Earth Orbit Satellite

Types of Satellites

- Geostationary/Geosynchronous Earth orbit satellite with a propagation delay of 250-280 ms.
- Medium Earth Orbit Satellites with a propagation dealy of 110-130 ms.
- Highly Elliptical Satellites with a variable propagation delay.
- Low Earth Orbit Satellite with a propagation delay of 20-25 ms.



Low Earth Orbit

A low Earth orbit (LEO) is an orbit around Earth with a period of 128 minutes or less and an eccentricity less than 0.25. Most of the artificial objects in outer space are in LEO, with an altitude never more than 2,000 km.

The mean orbital velocity needed to maintain a stable low Earth orbit is about 7.8 km/s, which translates to 28,000 km/h. However, this depends on the exact altitude of the orbit.

The pull of gravity in LEO is only slightly less than on the Earth's surface. This is because the distance to LEO from the Earth's surface is much less than the Earth's radius.

A low Earth orbit requires the lowest amount of energy for satellite placement. It provides high bandwidth and low communication latency. Satellites and space stations in LEO are more accessible for crew and servicing.

Since it requires less energy to place a satellite into a LEO, and a satellite there needs less powerful amplifiers for successful transmission, LEO is used for many communication applications, such as the Iridium phone system.

LEO satellites don't stay in fixed position relative to the surface. And a network of LEO satellites is necessary for LEO satellites to be useful.

Advantages

- It has least propagation delay (about 10ms) compare to other orbits due to closeness to the Earth. Due to lower latency, it can be used for realtime time critical applications.
- It eliminates need for bulky receiver equipments due to higher C/N signal ratio.
- It has flexible bandwidth
- It is also better for point to point communication.

Disadvantages

- A network of LEO satellites is needed, which can be costly.
- LEO satellites have to compensate for Doppler shifts caused by their relative movement.

Architecture of LEO

- Communication data passes through a satellite using a signal path known as a transponder.
- Satellites have 24-72 transponders. A single transponder is capable of handling up to 155 million bits of info per sec
- Today's communication satellites are an ideal medium for transmitting and receiving almost any kind of content – from simple to most complex contents.

Classes of LEO

- Little LEO
  - Operates under 1Ghz
  - Mostly used for low data rate messaging
  - Example: Orbcomm

- Big LEOs
  - Operates between 1 and 3 Ghz
  - Voice and limited data services
  - Example: Globalstar

- BroadBand LEOs
  - Provides communication similar to fiber optic networks
  - Example: SkyBridge

Applications of Satellite Networks

- Telecommunication
- Earth Observation
- Military Operations
- Natural Calamities
- Broadcasting Internet