

Satellite Communications

PRINCIPLE OF SATELLITE COMMUNICATION

Chapter One

Lecture 2

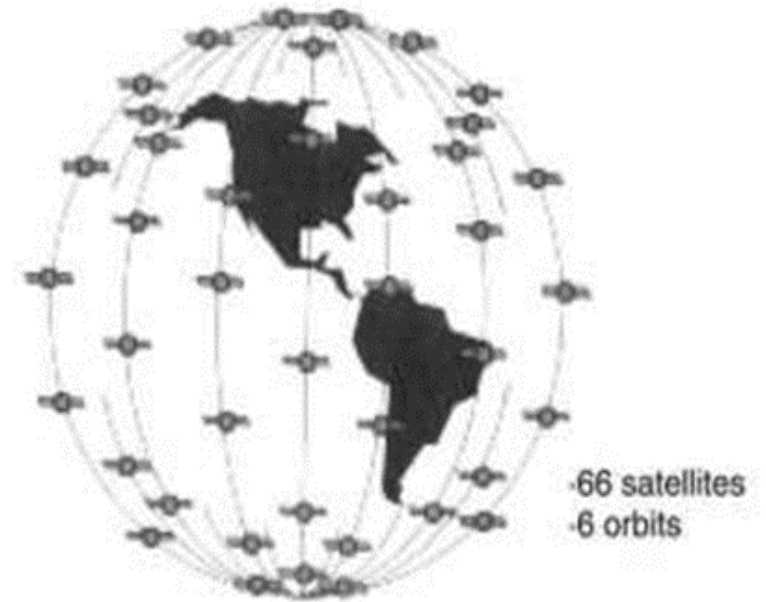
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Orbit Heights

- Geostationary Orbits (GEO) – at the special height of 36000km. The orbital period is 24 hours, so they remain stationary relative to the Earth's surface (most existing communication satellites – three to cover the entire surface of the Earth)
- Low Earth Orbit (LEO) – orbital heights of 500-2000km. Can be much smaller and cheaper, but need many to provide continual coverage (Iridium used 66 at altitude of 780km)
- Medium Earth Orbits (MEO) – altitudes of 5000-12000km. (Odyssey system used 12 satellites at 10370km for complete global coverage)

- A non-GEO is termed to the orbits that are below a mean altitude of about 36,000 km have periods of revolution shorter than 24 hours so the Iridium system uses multiple satellites to provide continuous coverage of a given region of the Earth because the satellites appear to move past a point on the Earth.
- Advantage of a non-GEO satellite network:
range to the user is shorter; hence, the less radiated power is required and the propagation delay is reduced as well.

Note that Satellites designed to last only about 15 years in orbit because of the practical inability to service a satellite in GEO and other stuff like (fuel, battery cells, and degraded or failed components)



Satellite Communications - today

- Today there are nearly 200 GEO satellites in operation
- Satellite systems dominate the international long distance telephone, and the TV broadcasting, markets
- These satellites are built as transponders – to relay the signals from the Earth back to Earth
- Satellite systems were never able to be competitive in the Mobile Cellular market ('satellite base-stations')
- Another major satellite system is the GPS (Global Positioning System)
- There are other satellite systems.

Satellite Communications - overview

- Most successful satellite communications have been GEO
- Altitude of 35786km, period of 24 hours
- Fixed location relative to Earth, so no complex tracking by Earth stations
- Link distance is 38500km typically – hence received signals are very weak
- Require large Earth station antennae ('satellite dish'), but over time satellites have become more powerful - > VSAT (very small aperture terminals)
- Use frequencies in the range 1-50GHz
- Issues – distance (weak signal), time delay (~ 0.5 s), polar regions not covered

Q: What are the big different
between
the GEO and NON GEO
in general