

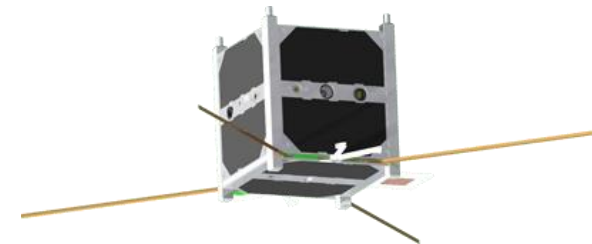
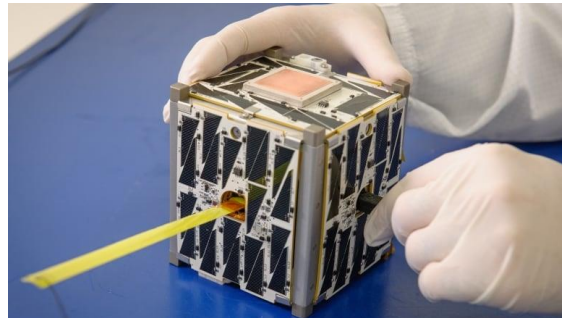
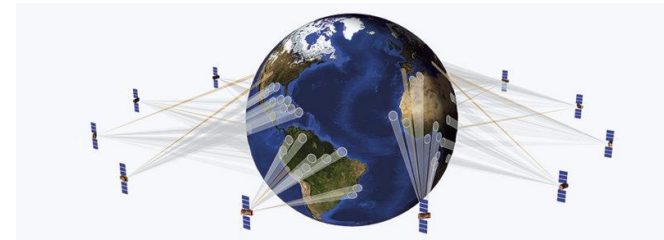
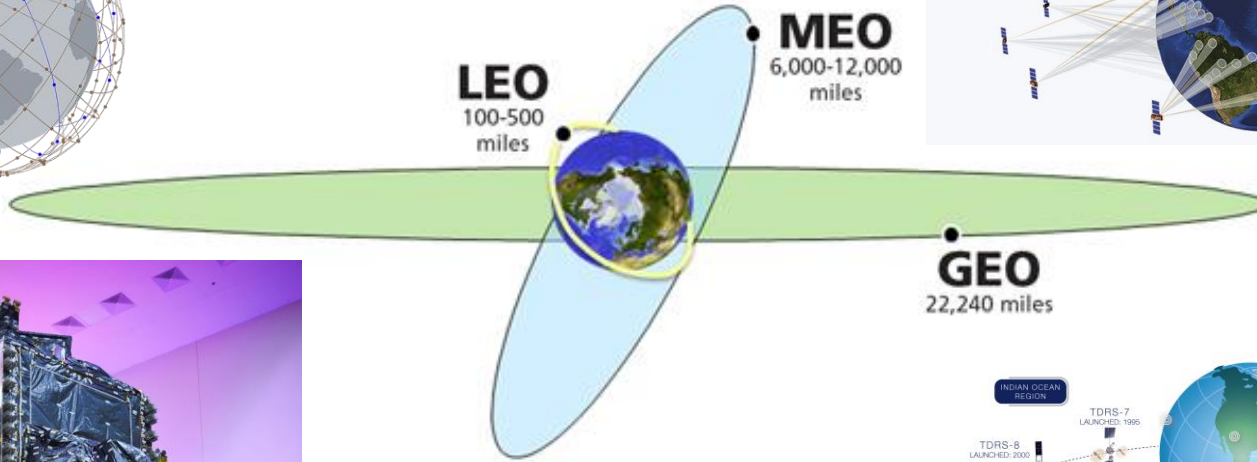


Fiber Like Solutions over Satellite through the use of Aggregation and Multi-Constellation



Feb 10, 2021

What is NewSpace (and how is it spelled)



NewSpace

Satellite Launch Price per Kg

Orbit	Miles High	Price / Kg
LEO	100 – 1200 mi	\$5,000
MEO	1200 – 22,000 mi	\$15,000
GEO	~ 22,000 mi	\$30,000

Satellite Launch Price of 10,000 kg FSS Satellite

Orbit	Launch Vehicle	Price / Kg
LEO	Med Lift - Falcon 9	\$56M
GEO	Heavy Lift – Delta IV	\$300,000

Source: Cannae Corporation

NewSpace

	GEO/ HTS Constellation	MEO Constellation	LEO Constellation
Cost per Kg to Orbit	●	●	●
# Sat for world wide coverage	●	●	●
Network Mgmt / Complexity	●	●	●
Ground Seg Cost / Complexity	●	●	●
Latency	●	●	●
Price Per User Bit	?	?	?

Multi-Tiered, Open and Closed Networks, wide set of business models - little to no subsidizing

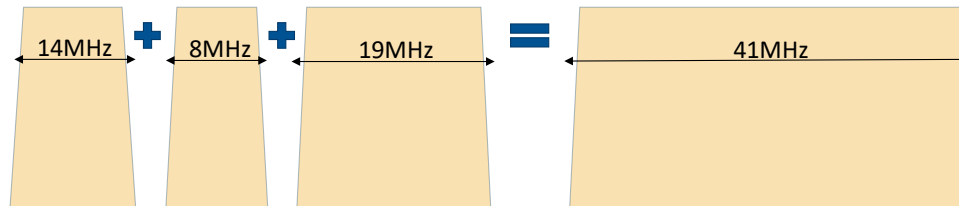
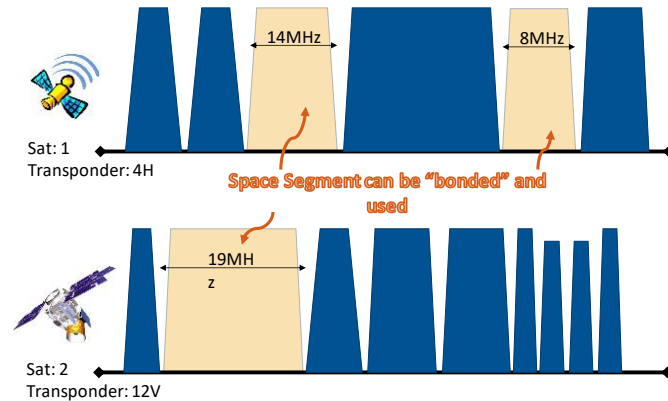
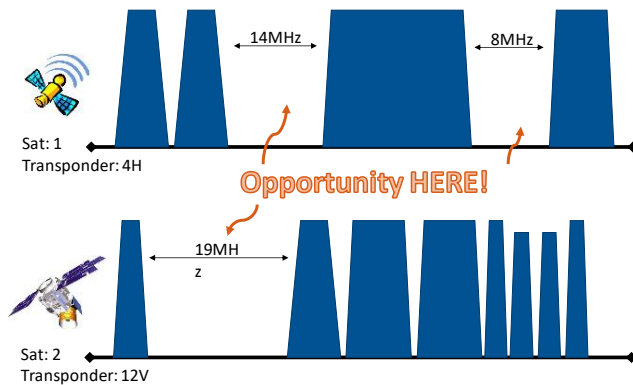
Controlled business model, mostly selling services, little to no subsidizing

Mostly closed networks, focused business models, highly subsidized

“Fiber-in-the-Sky” Quality of Service

- GEO / HTS Focus

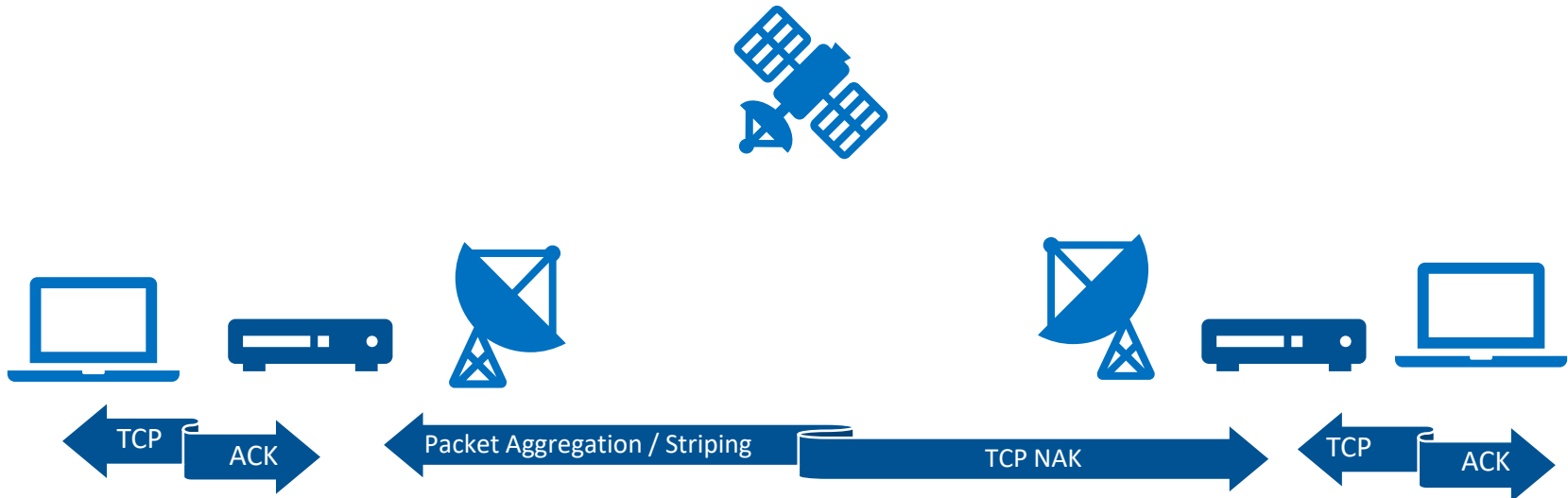
- Transponder aggregation carrier bonding (Fiber capacities)
- WanOp Acceleration (combat latency)



“Fiber-in-the-Sky” Quality of Service

- GEO / HTS Focus

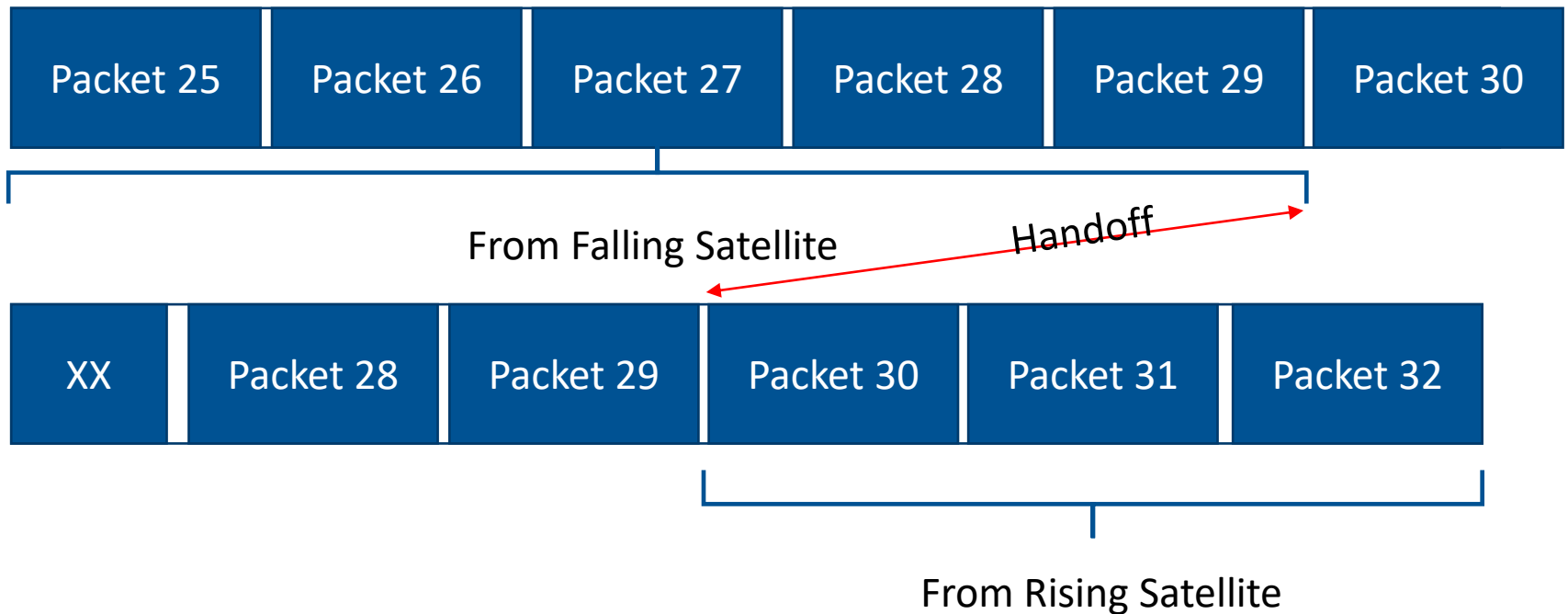
- Transponder aggregation carrier bonding (Fiber capacities)
- WanOp Acceleration (combat latency)



“Fiber-in-the-Sky” Quality of Service

- MEO Focus

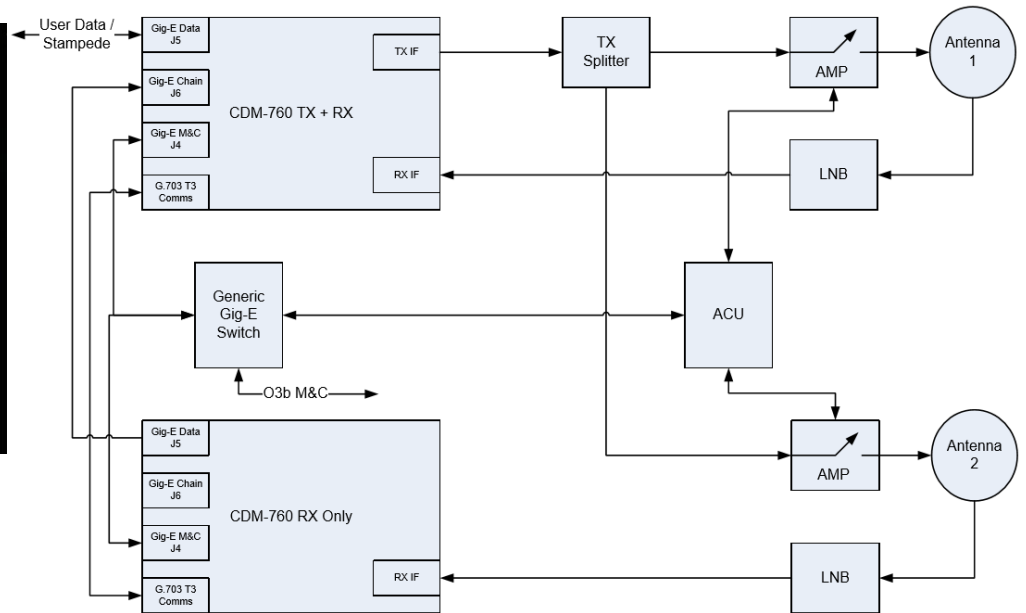
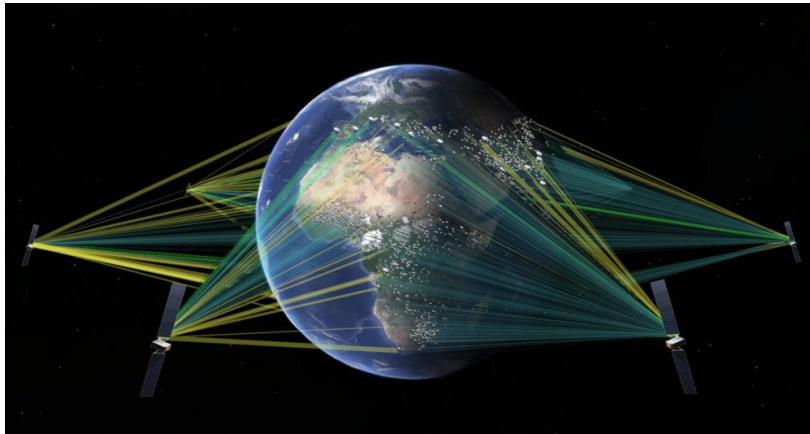
- Antenna / Satellite Handover
- Packet de-duplication and latency modification



“Fiber-in-the-Sky” Quality of Service

- MEO Focus

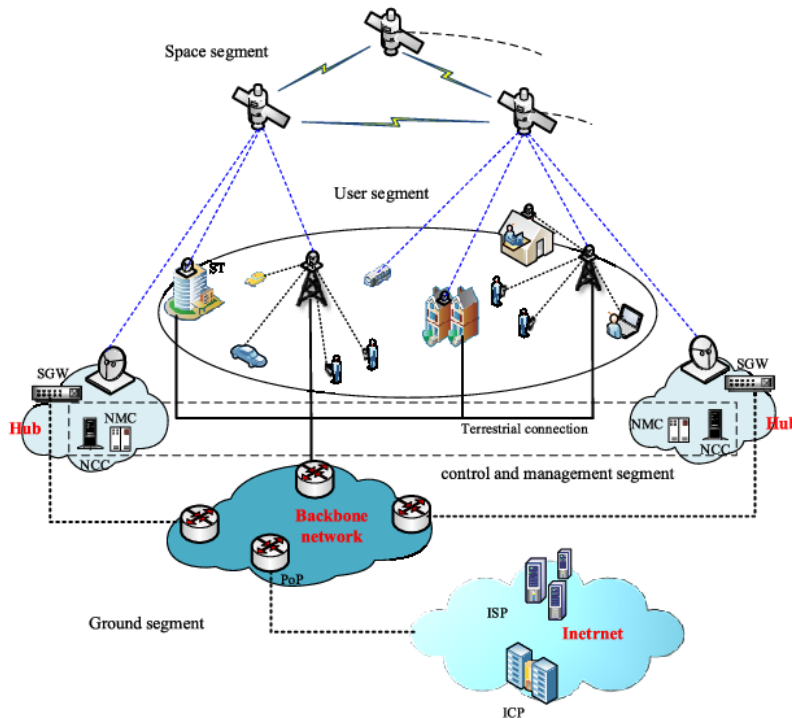
- Antenna / Satellite Handover
- Packet de-duplication and latency modification



“Fiber-in-the-Sky” Quality of Service

- LEO Focus

- All solution set required for MEO / No need for WanOp Acceleration
- **System Level Orchestration**
- Added Doppler Compensation
- Fast Acquisition may be required
- New Waveforms being developed

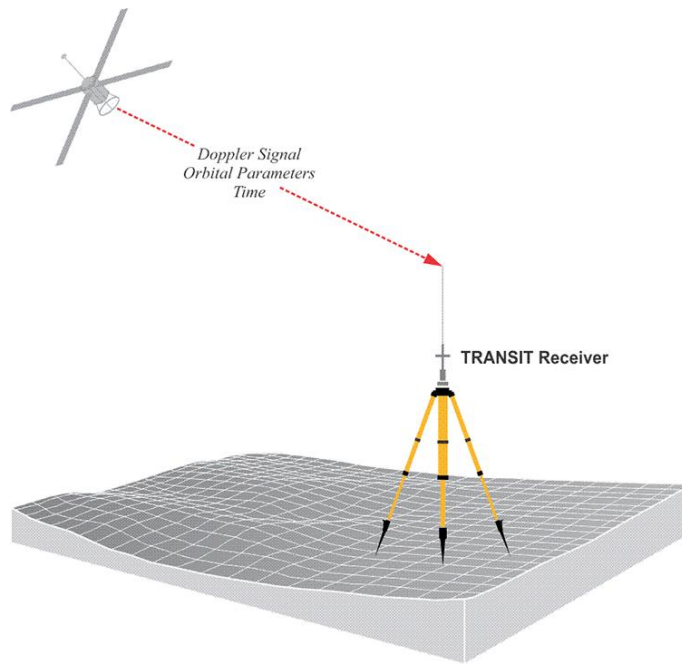


System wide global orchestration between the space segment and the ground segment far more complicated than any other constellation.

All equipment must move, tune, switch, re-route, and act on a worldwide “plan” to ensure proper use of resources. Software defined networking and software defined satellites and terminals meet with VM scale and elasticity.

“Fiber-in-the-Sky” Quality of Service

- LEO Focus
 - All solution set required for MEO / No need for WanOp Acceleration
 - **System Level Orchestration**
 - **Added Doppler Compensation**
 - **Fast Acquisition may be required**
 - New Waveforms being developed



Aside from all MEO challenges with antenna handover LEO presents challenges with carrier acquisition and tracking due to rapid changes in Frequency offset.

Acquisition can be “blindly” widened in some cases. Other cases will require frequency offset messaging.

“Fiber-in-the-Sky” Quality of Service

- LEO Focus
 - All solution set required for MEO
 - No need for WanOp Acceleration
 - Added Doppler Compensation
 - **Fast Acquisition may be required**
 - **New Waveforms being developed**





Comtech EF Data
2114 West 7th Street
Tempe, AZ 85281
USA

Tel +1.480.333.2200
FAX +1.480.333.2540
sales@comtechefdata.com
www.comtechefdata.com

