



Internet Society  
Interplanetary  
Chapter



# Toward the Interplanetary Internet - from the Moon, Mars and beyond-

2024 May 18  
Yosuke Kaneko  
IPNSIG President

44th Virtual UNISEC-Global  
Meeting

# Content

- Introduction of IPNSIG
- Momentum toward Lunar Communication Infrastructure
- Deep Space Networking challenges
- Opportunities to get involved



# IPNSIG Overview

~ Interplanetary Networking Special Interest Group ~

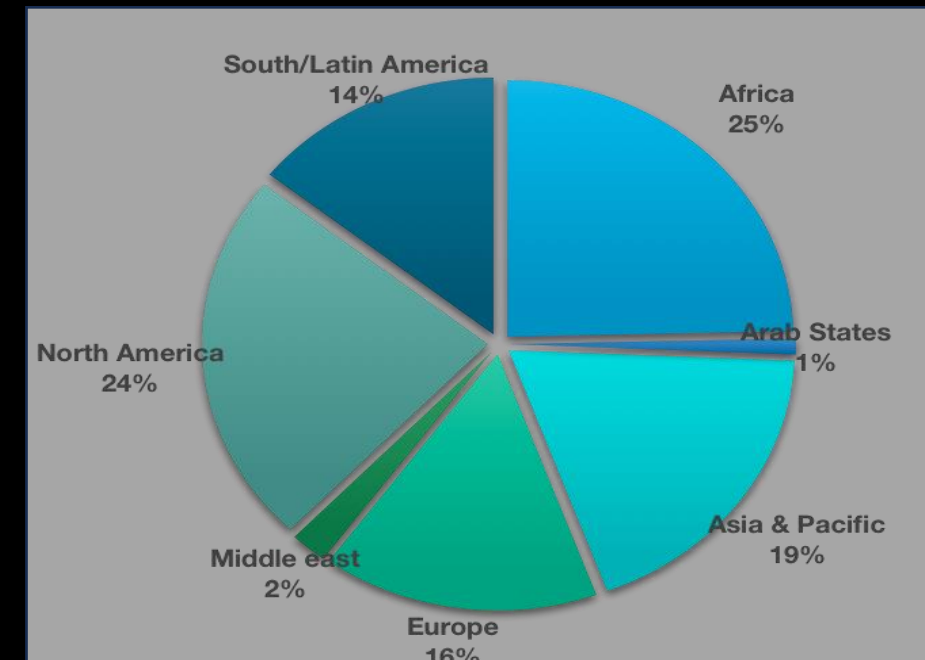
- Founded in 1998 by Vint Cerf, known as the “Father of the Internet”
- Kaneko Assumed President since 2020
- More than 1000 members across the globe
- Dr. Scott Pace, former US executive secretary of the National Space Council, former NASA Chief Scientist, Dr. Jim Green and many distinguished members
- US non profit to facilitate the development of the Interplanetary Internet



Vint Cerf氏  
(IPNSIG Board member)

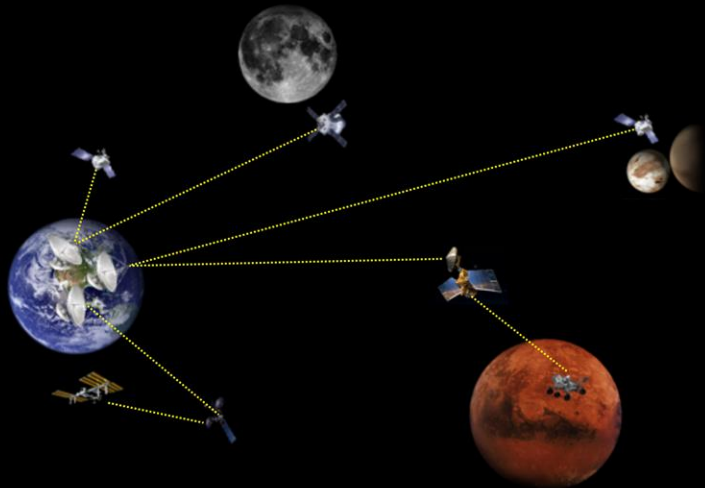


Yosuke Kaneko  
(President)



# IPNSIG's Vision

Today

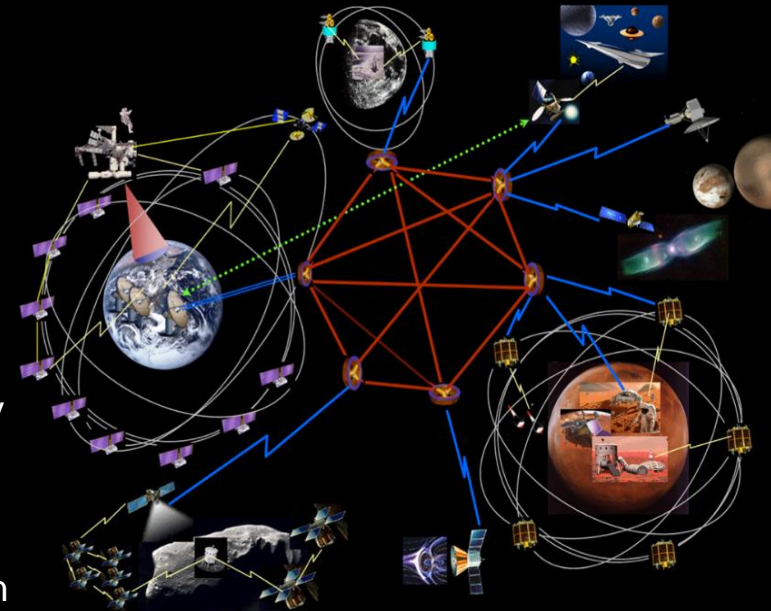


Point to Point Comm



Interplanetary Internet

Discovery  
Science  
Innovation



Sustainability  
Resilience  
Inspiration

As a common structure for the benefit of humanity

# Development of the Lunar Comm Infrastructure, late 2020s -

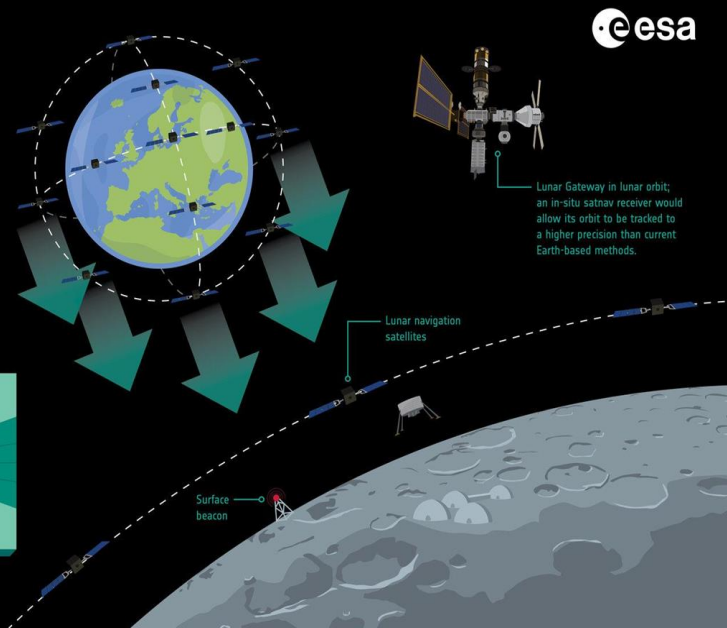
## MOONLIGHT

### Navigation and Telecommunications for the Moon

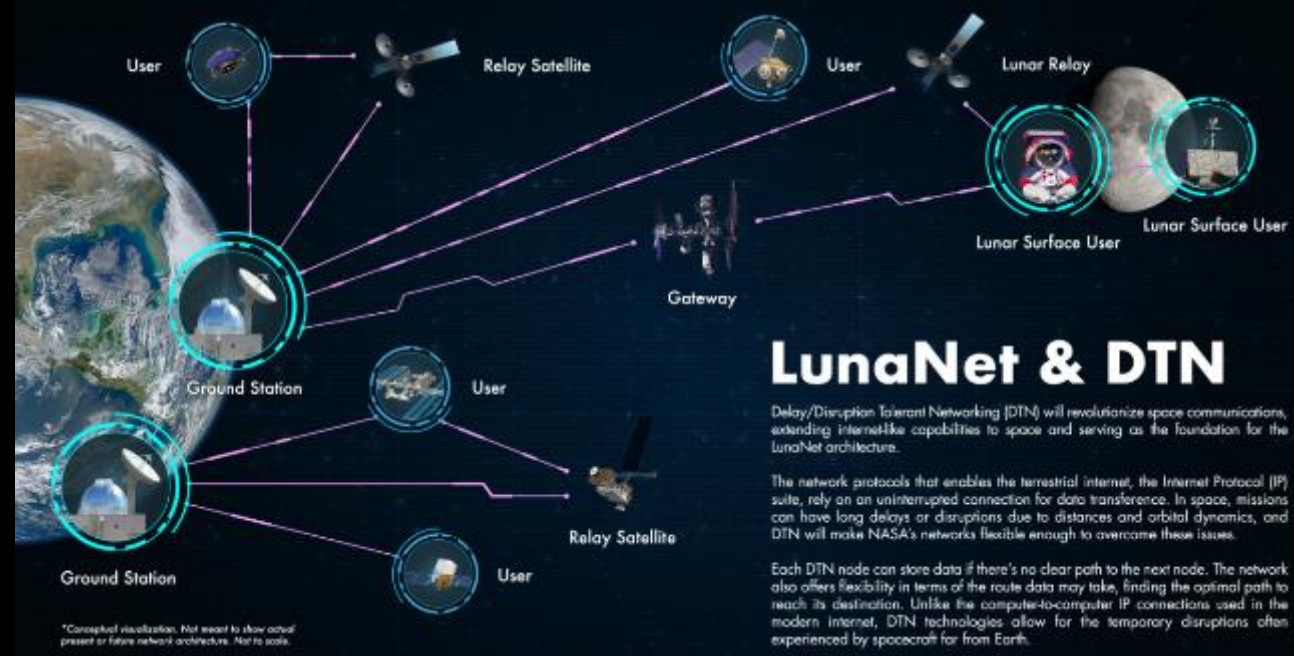
ESA's Moonlight initiative involves expanding satnav coverage and communication links to the Moon. The first stage involves demonstrating the use of current satnav signals around the Moon. This will be achieved with the Lunar Pathfinder satellite in 2024. The main challenge will be overcoming the limited geometry of satnav signals all coming from the same part of the sky, along with the low signal power. To overcome that limitation, the second stage, the core of the Moonlight system, will see dedicated lunar navigation satellites and lunar surface beacons providing additional ranging sources and extended coverage.



#Moonlight



ESA - "Moonlight"



NASA - "LunaNet"

# Global Interest in LunaNet

Airbus  
ACM  
AEM  
AIM  
ALTEC  
Andana Consulting  
Argotec  
Arkedge Space  
ASRC Federal  
Astrobotic

Atlas Ground  
Autonomic  
Enterprise  
Avatar Technologies  
AWS  
Axient Corp  
Axyde  
Blue Canyon Tech  
Blue Origin

CACI  
Carahsoft  
Centuria  
Cesium Astro  
CPII  
Craigtech Inc  
Crean Associates  
Creaninc  
Crescent Space

Dell  
Delmarva Engineering  
Delynych Consulting  
Dispel  
Draper  
Hedron Space  
Fibertek  
g2govsolutions  
GDIT  
General Dynamics Mission Systems  
GMV-NSL  
Goonhilly

Hipsat  
HPE  
Infinity Aero  
Inmarsat  
Intelsat  
Intelsat General  
Intuitive Machines  
ISDRC  
inspace Inc  
istellar

Jacobs  
Javad  
JHU/APL  
KBR  
KDDI  
KDR Solutions  
KSAT

MDA  
Microsoft  
Monetti and Associates  
Moog  
Moorehead State  
Nanoracks Europe  
Neuro Space  
Ni  
Northrop Grumman

OHB System  
Omitron  
Onevue Consulting  
Orbitzone  
PARI  
Parsons US  
Peraton  
PJR Corp  
qwaltec

Raytheon  
Relative Dynamics  
Inc.  
RKF Engineering  
RTX  
SAIC  
SBC Global

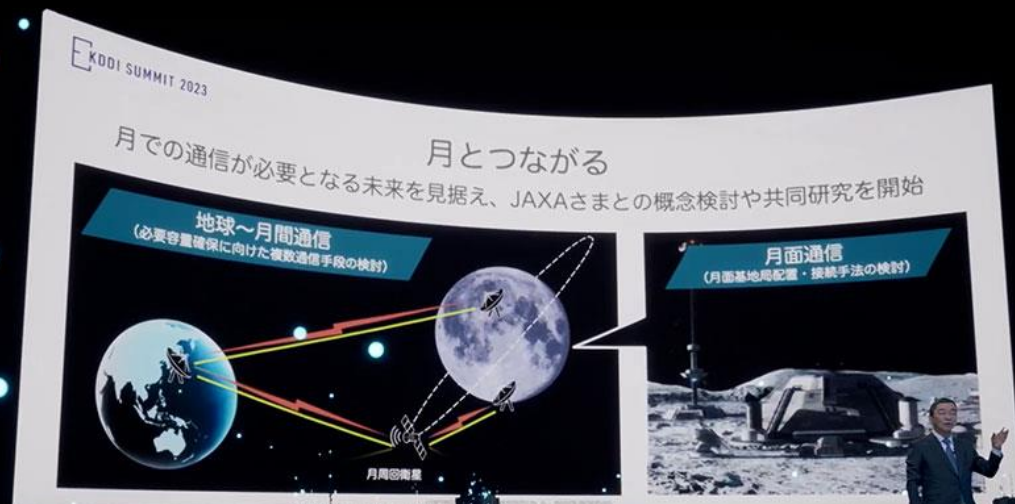
Scherff  
Consulting  
SES  
Sncorp  
Space Initiatives  
Space X  
Spacelink

SSC Space  
SSTL  
Stellar Solutions  
Stottler Henke  
TECHPROMANAGERS  
Telespazio  
Thales Alenia Space  
Thales group US

L3harris  
Leaf Space  
Linquest  
LMCO

Univ of Alaska  
Viasat  
Virtualgeo

# Industry's plans

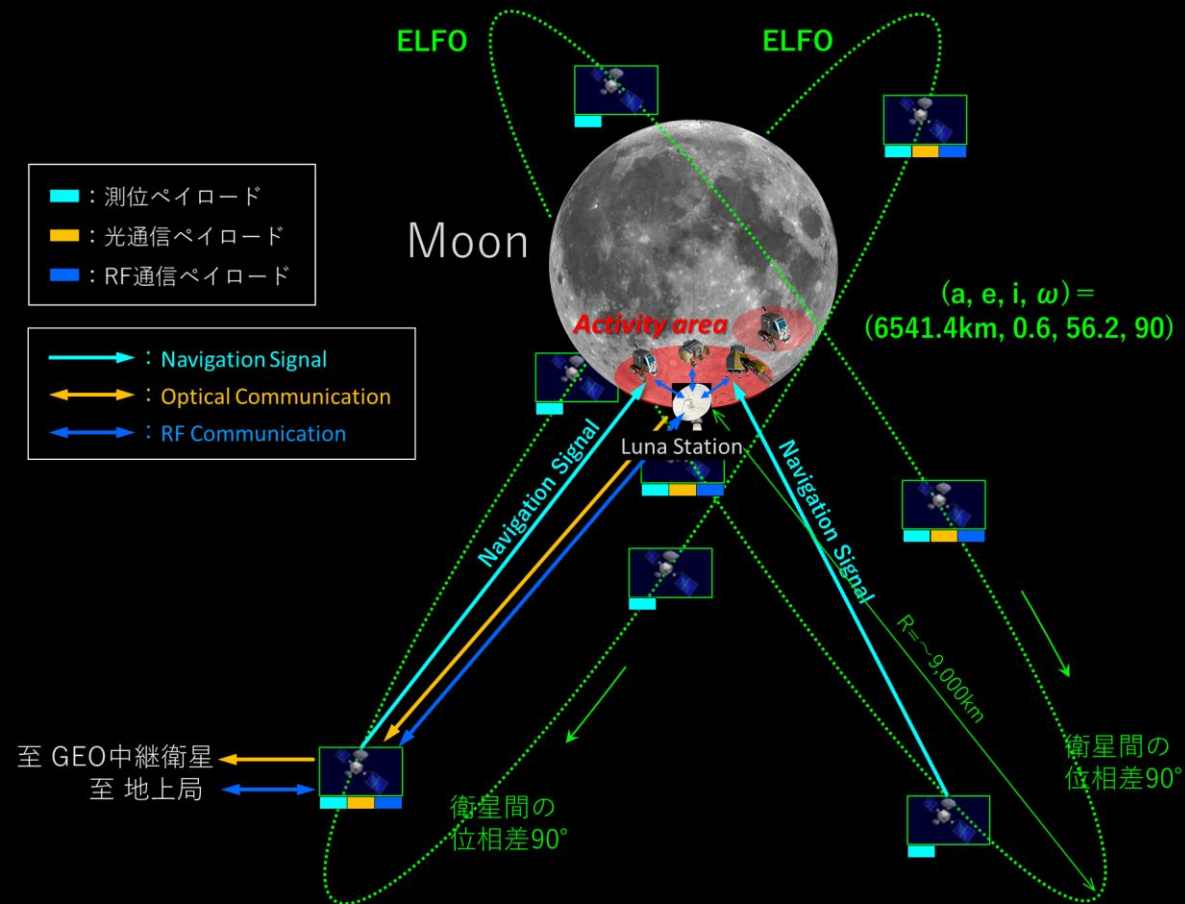


Nokia demonstrating Lunar 4G

KDDI toward Lunar Cellular network

# JAXA's efforts

## Assessment on Lunar Communication and Navigation architecture and Research on Optical Communication





# China's efforts

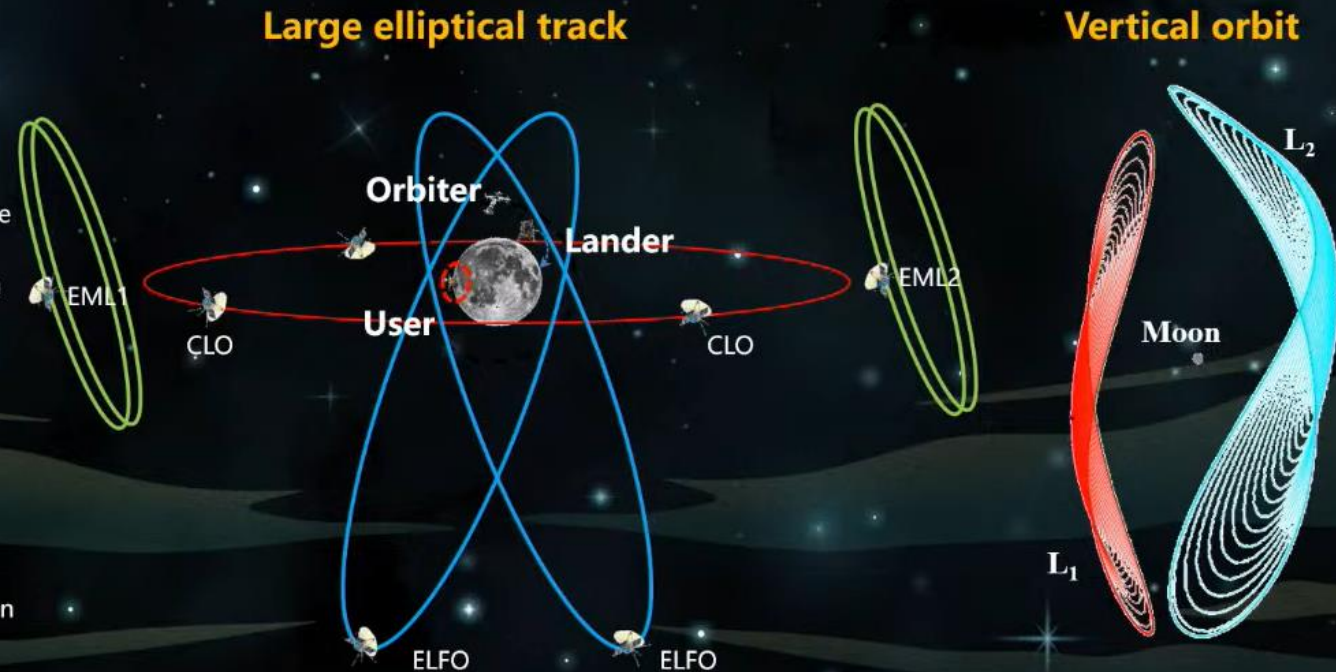
## Queqiao V2.0

**Overall objective:** To establish an Earth-Moon main link and realize the whole Moon communication and remote sensing as well as regional navigation.

□ **Main Link**  
Open architecture

□ **Coverage capacity**  
The regions including south pole of the Moon, latitude larger than 40° and farside where quadruple coverage was achieved.  
One coverage for the whole Moon

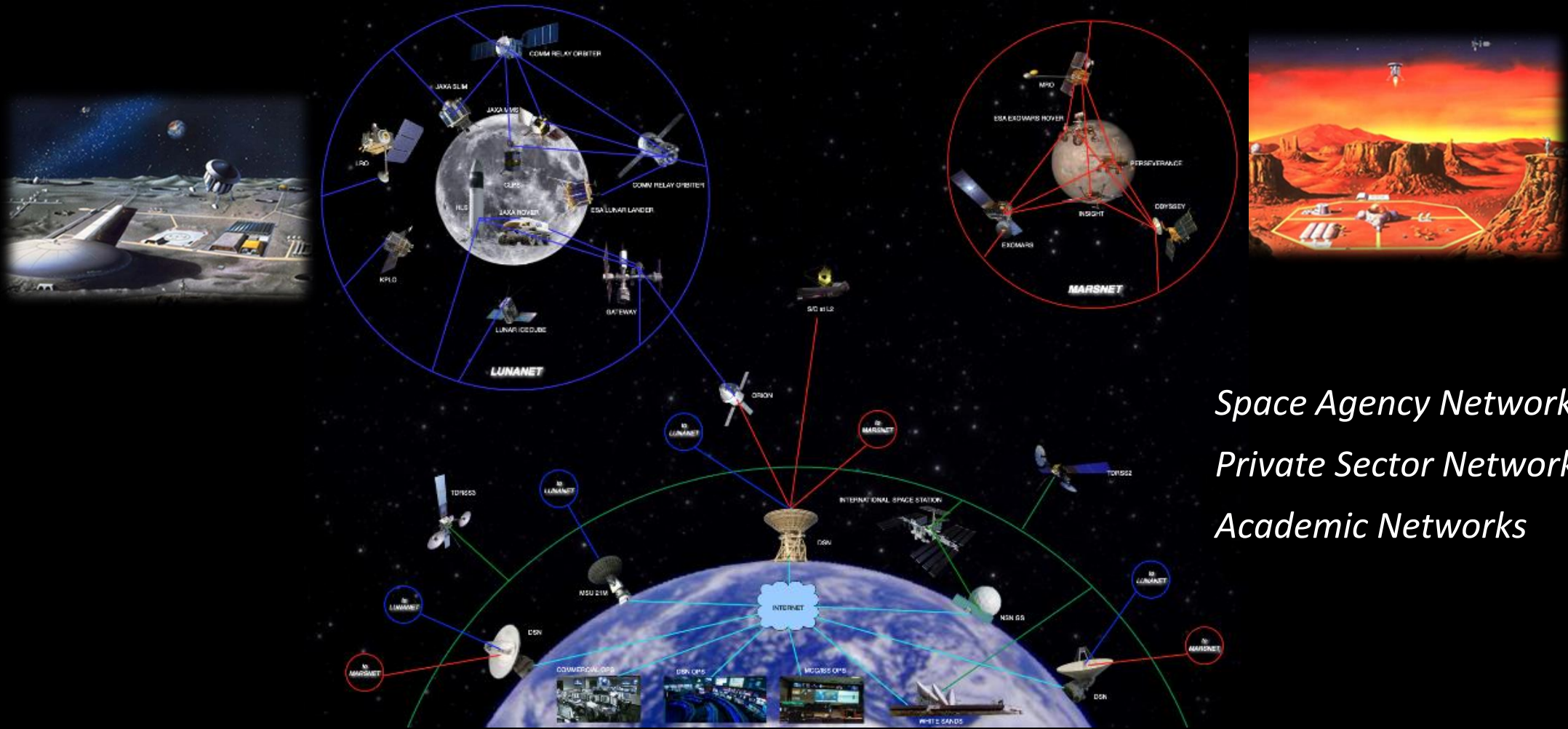
□ **Example of topology architecture (16 satellites)**  
3 EML satellites (L1)  
3 EML satellites (L2)  
1 EML satellite (L3)  
2 ELFO satellites  
6 CLO satellites  
1 GEO orbital interplanetary station



**Establish Earth-Moon link and realize whole Moon Communication coverage**

# The Interplanetary Internet

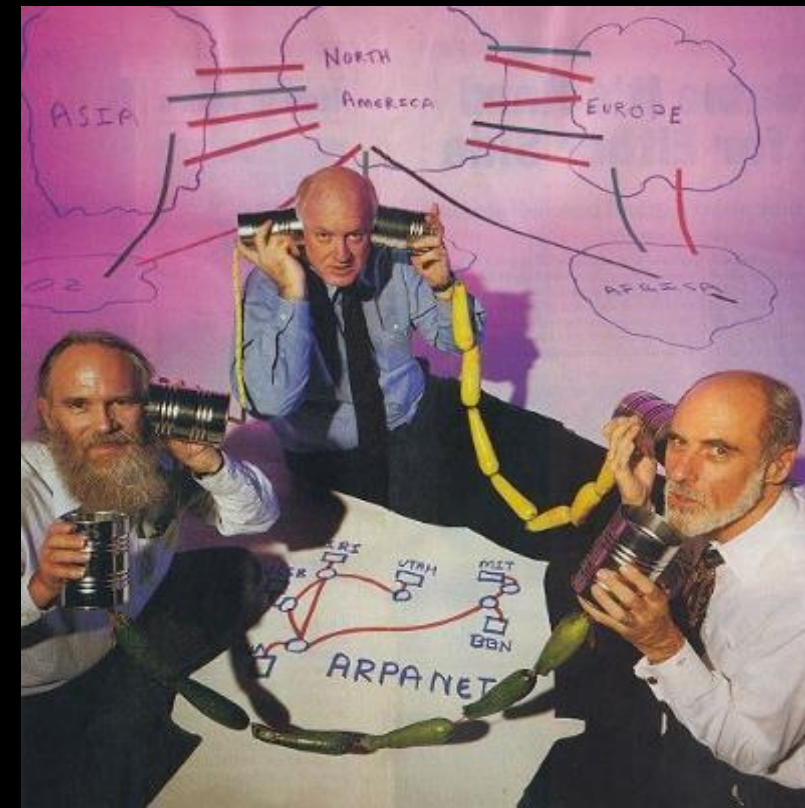
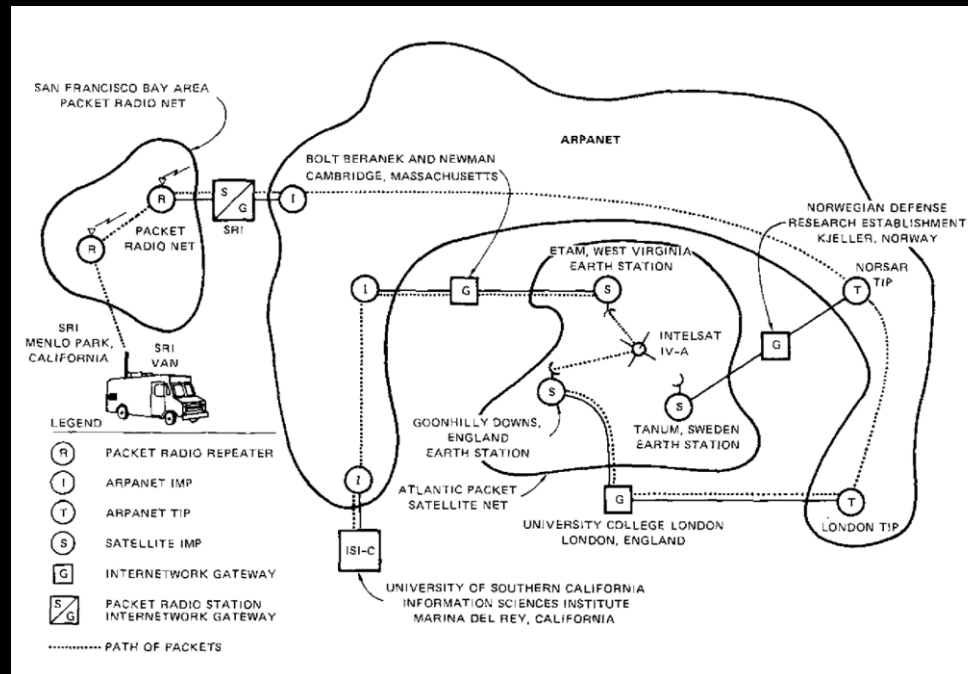
## Toward a "Common Structure"



*Space Agency Networks*  
*Private Sector Networks*  
*Academic Networks*

# Analogy

- 1983 Jan 1st, TCP/IP protocol ran on ARPANET, SATNET, PRNET via Gateways.  
➡ the **“Internet”** became Operational
- Likewise, the age of **“network of networks in Space”**
  - Different networks from Different actors

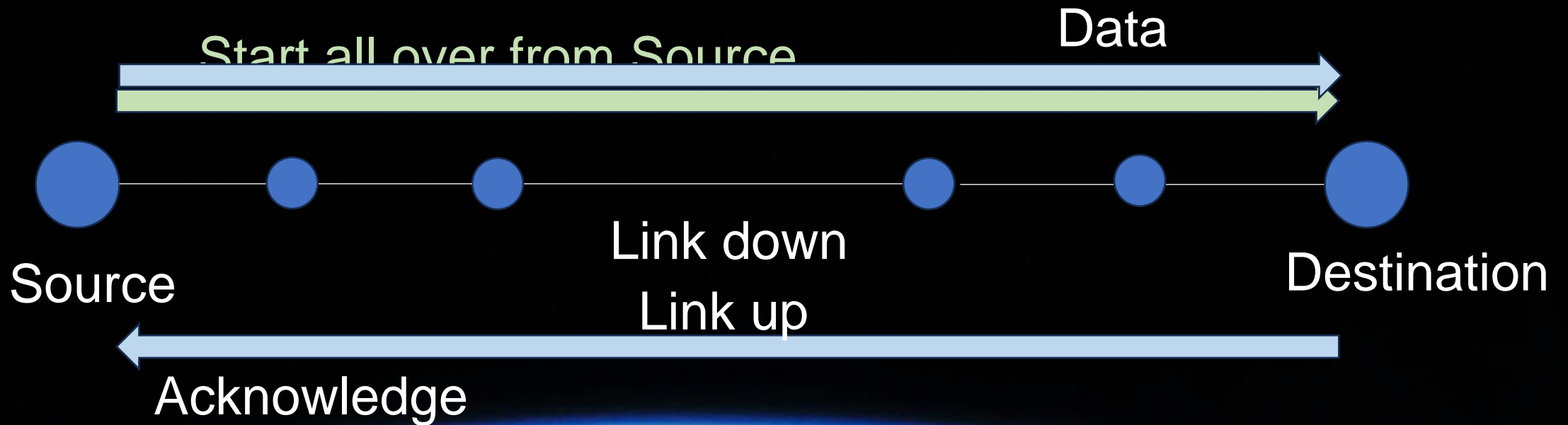


# Deep Space Challenges

## Astronomical Distance and Planetary Motion

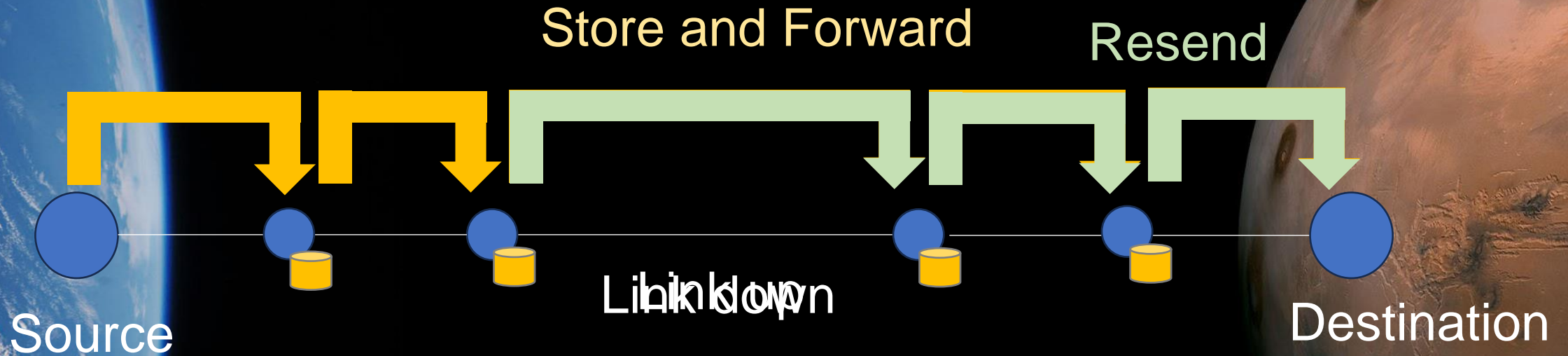


# Internet (TCP/IP)



Does not work very well at Interplanetary distance

# DTN



Resends from nodes in between

- Tolerance to Delay and Disruption
- NASA, JAXA etc conducting R&D

# Another “internet” ?



Does it connect with Earth Internet?  
Use of IPv6?  
Autonomous Systems on the Moon?  
Will we use BGP?  
What about DNS?  
Web browsing (WWW) from the Moon?

Earth Internet



Moon “internet” ?

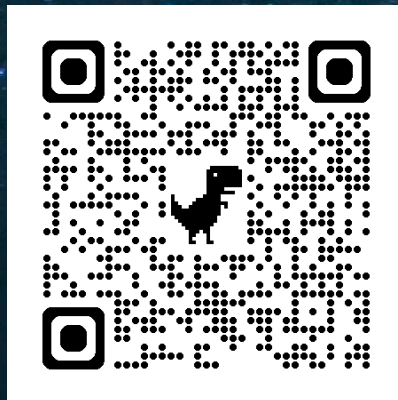
# Opportunities to get involved

## IPNSIG

- ✓ IPNSIG Academy - Webinars on DTN and on architecture and governance of the Interplanetary Internet
- ✓ IPNSIG Projects – demonstrating DTN and its utility in terrestrial / space environments



<https://www.ipnsig.org/>



Join us!



ITU Secretary General  
Doreen Bogdan-Martin and Vint Cerf



Husbandry of Reindeers (Sweedon)



# Opportunities to get involved

## WIDE – Widely Integrated Distributed Environment

- ✓ Students and engineers from around the world
- ✓ R&D of various Internet Technology
- ✓ Space WG – focused on Interplanetary Networking



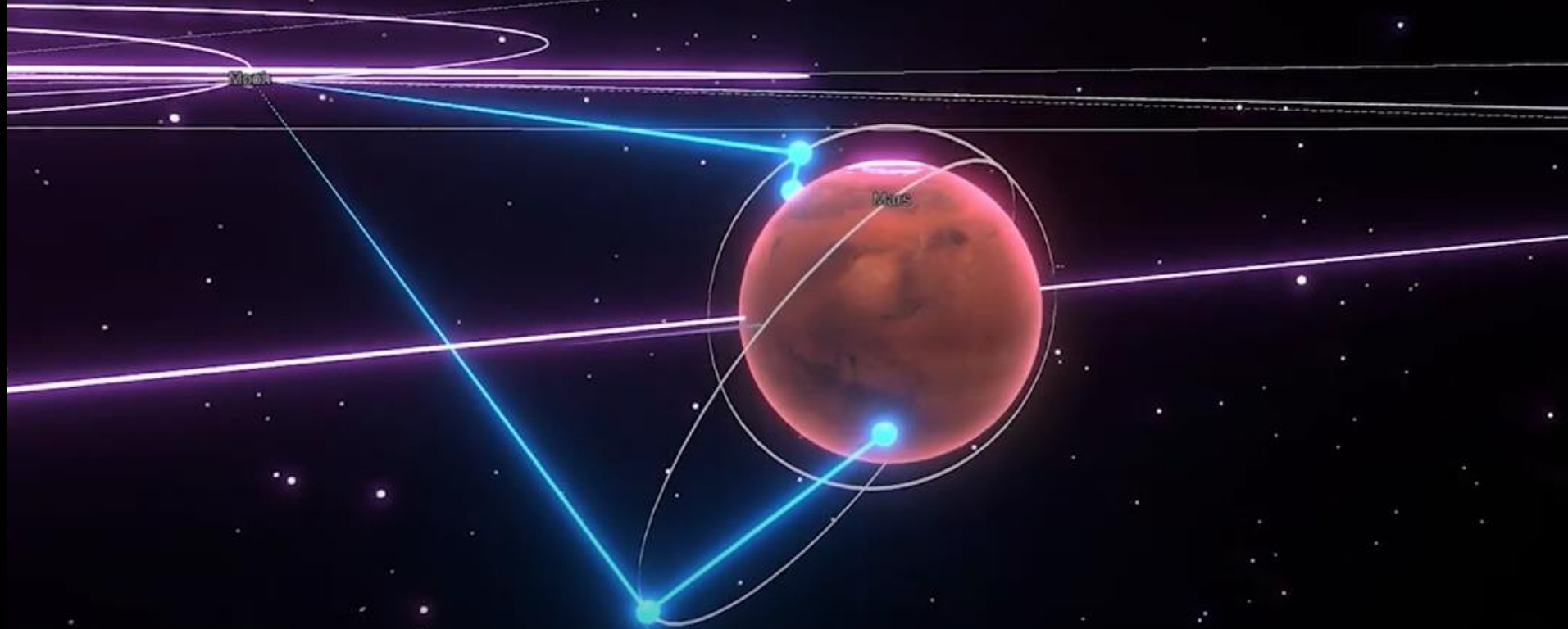
<https://www.wide.ad.jp/>

## IETF – Internet Engineering Task Force

- ✓ Open forum for standardizing Internet Technology
- ✓ WGs on Interplanetary Networking protocol standards
  - DTN WG (<https://datatracker.ietf.org/wg/dtn/about/>)
  - Deep Space IP (<https://deepspaceip.github.io/>)



**from the Moon, Mars and beyond**



**Thanks for your attention!**