



# **Overview of the current CCSDS Program of Work**

**Adrian J. Hooke**

Chairman, CCSDS Engineering Steering Group

**CCSDS Management Council Meeting**

**Moscow, Russia**

**28 September 2006**

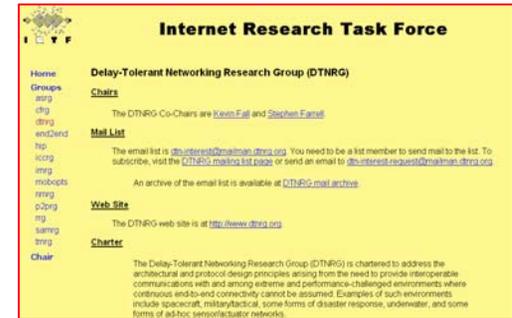
# Some Of The Groups Working in Space Standardization



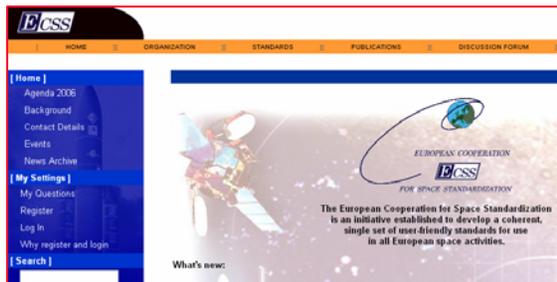
- **CCSDS:** open international standards for space mission interoperability



- **OMG:** industry standards for exchange of application information among vendor products



- **IRTF:** open international standards for Disruption Tolerant Networking (DTN)



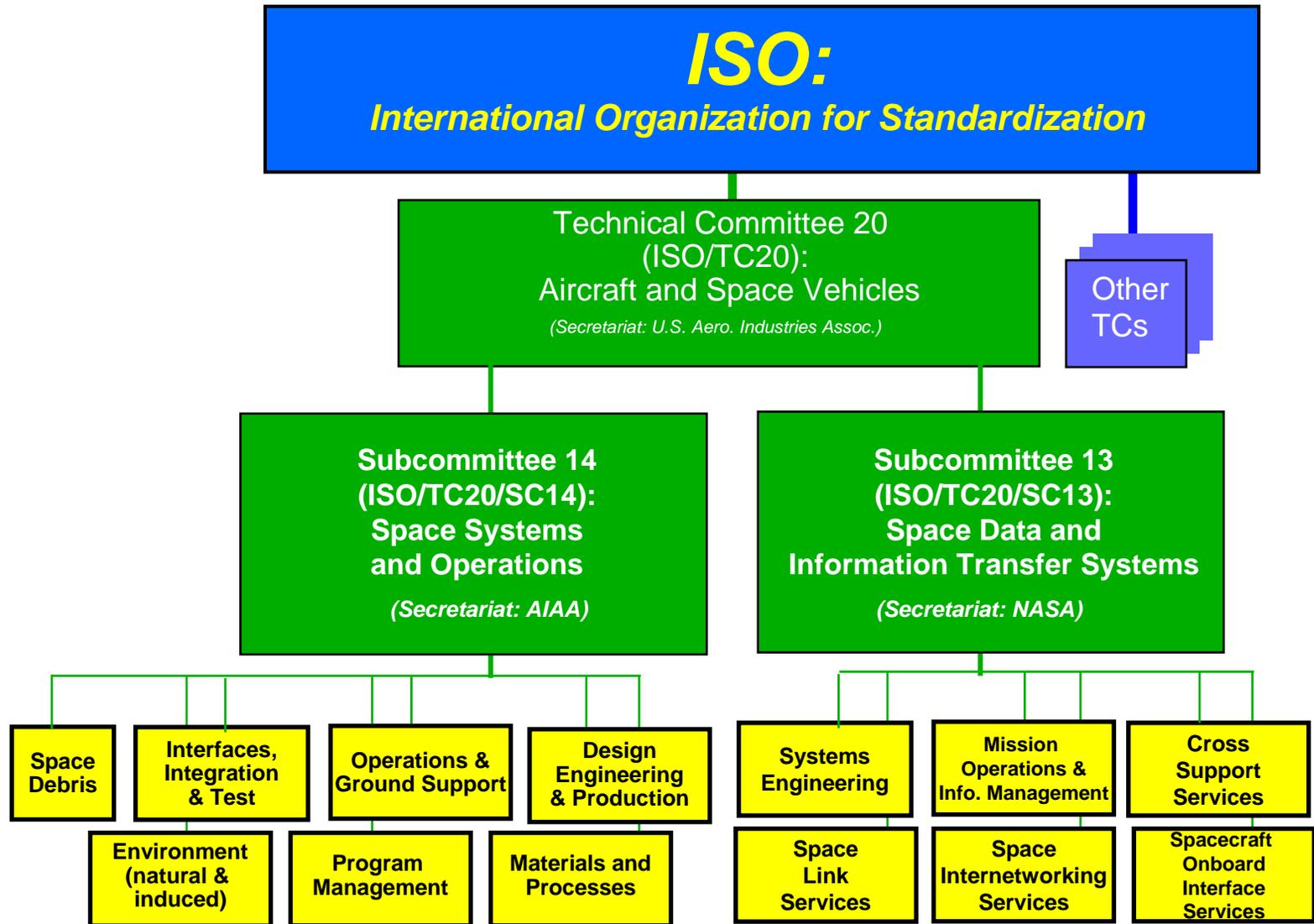
- **ECSS:** European regional standards for space missions



- **AIAA:** North American regional standards for space missions



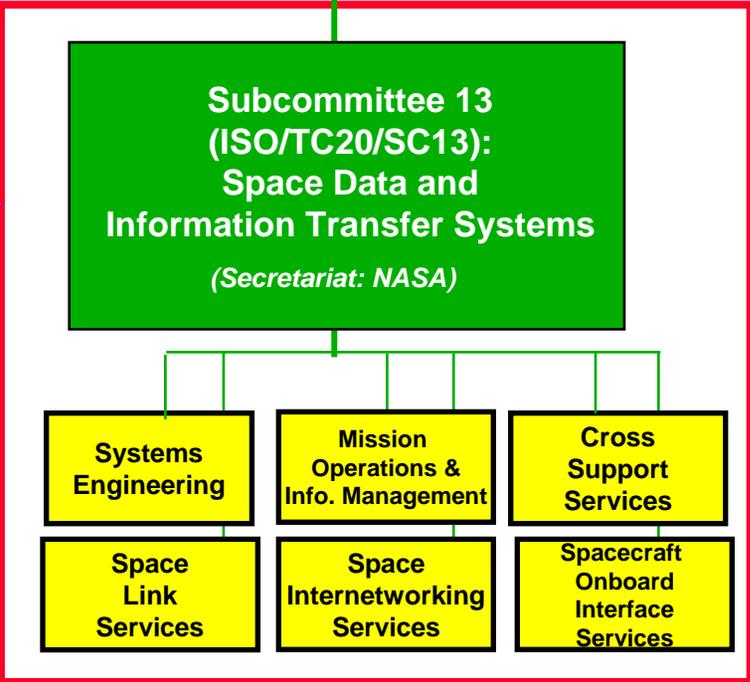
# International Space Standards



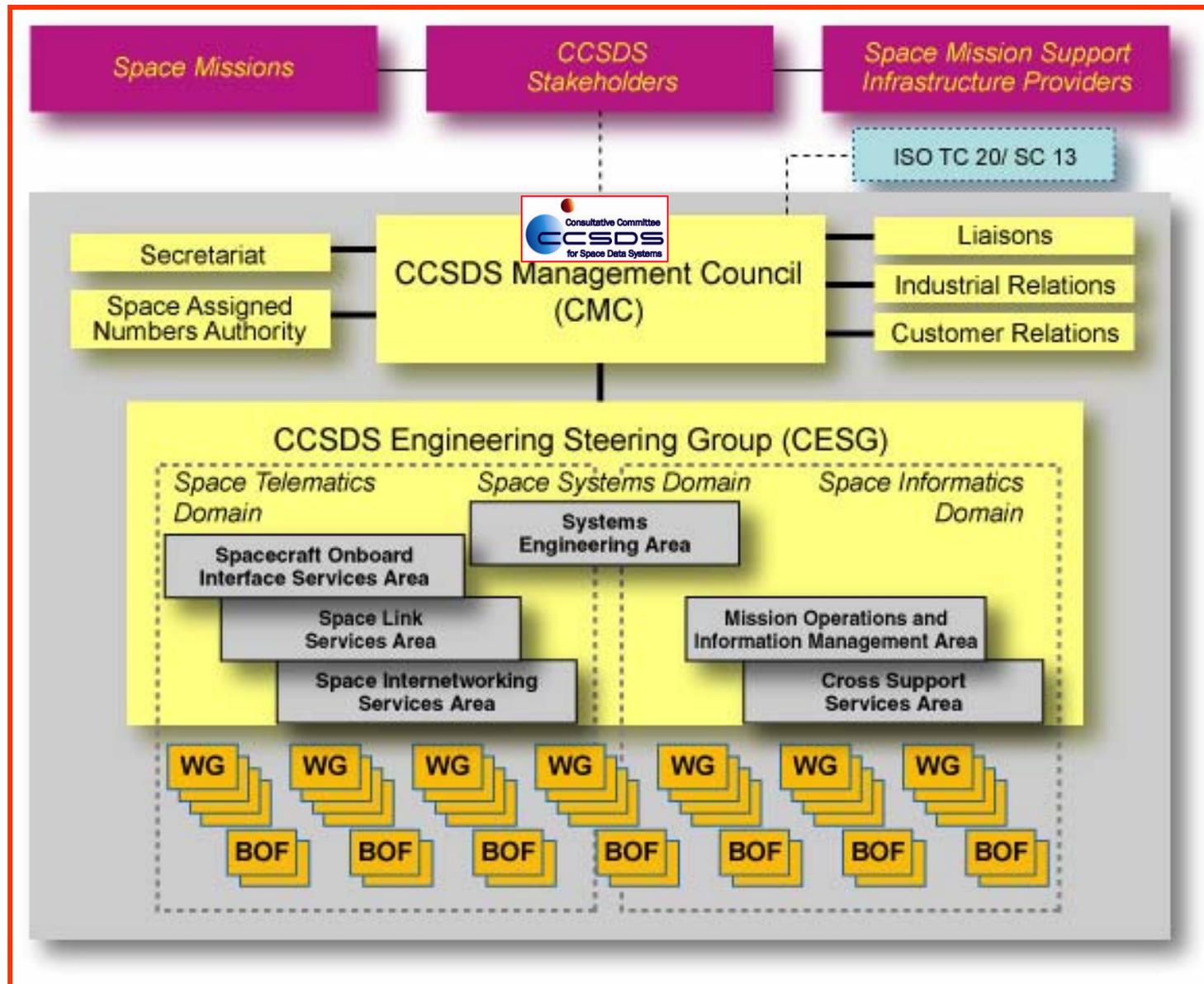
# Space Data Standards

**ISO:**  
*International Organization for Standardization*

Technical Committee 20  
(ISO/TC20):  
Aircraft and Space Vehicles  
*(Secretariat: U.S. Aero. Industries Assoc.)*



# Consultative Committee for Space Data Systems (CCSDS)

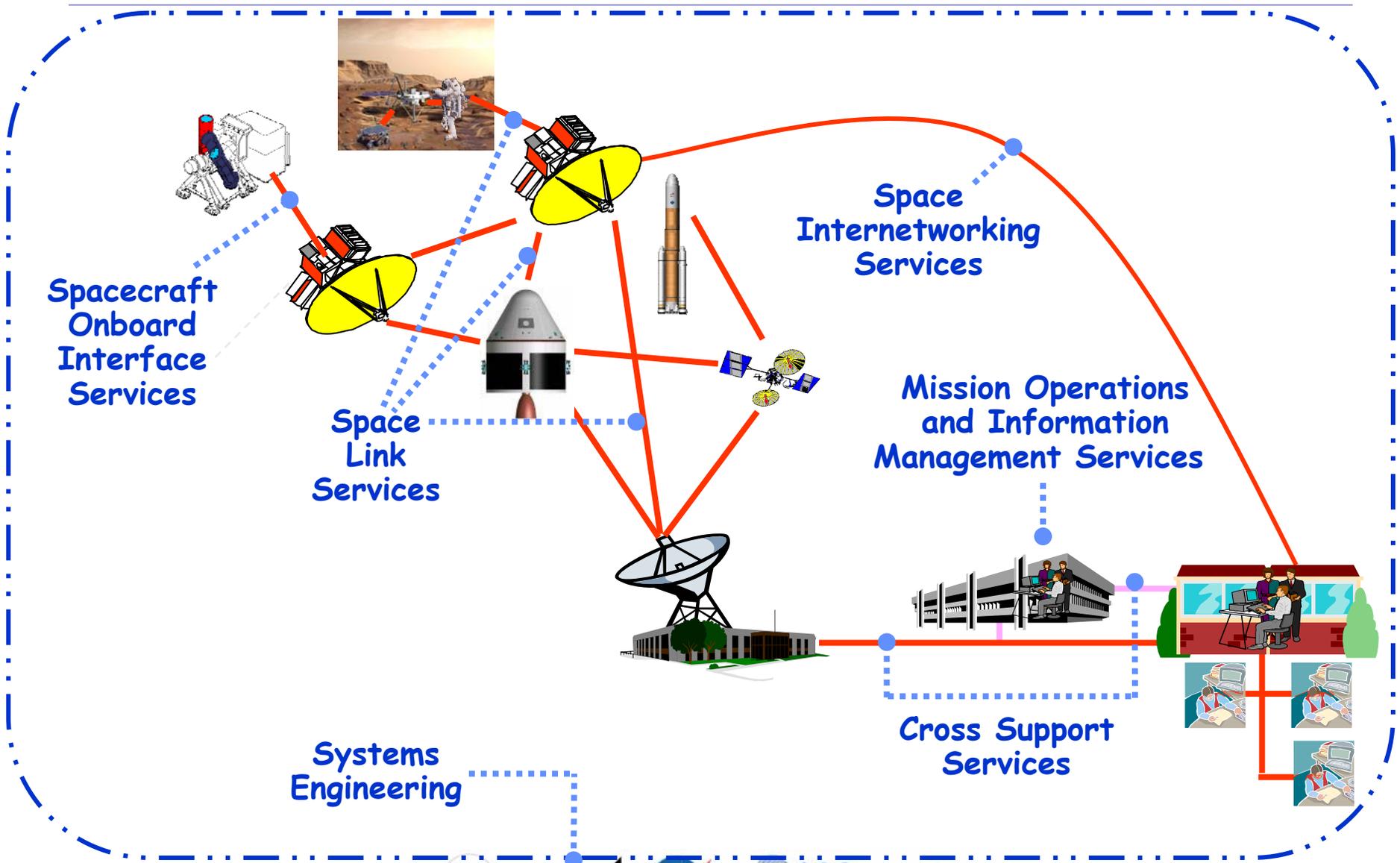


ASI/Italy  
 BNSC/UK  
 CNES/France  
 CSA/Canada  
 DLR/Germany  
 ESA/Europe  
 INPE/Brazil  
 JAXA/Japan  
 NASA/USA  
 FSA/Russia

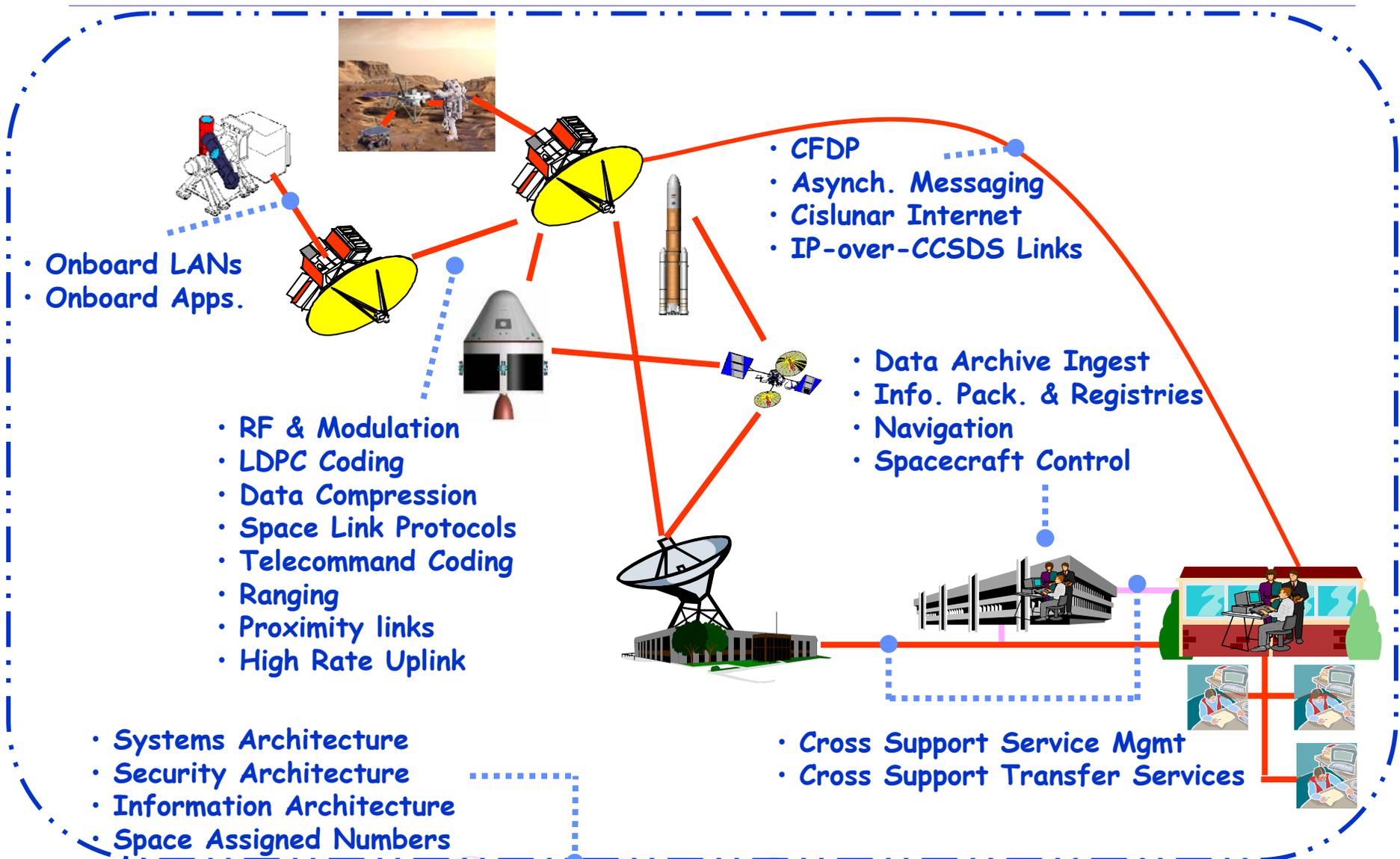
ASA/Austria  
 CAST/China  
 CRC/Canada  
 CRL/Japan  
 CSIR/South Africa  
 CSIRO/Australia  
 CTA/Brazil  
 DSRI/Denmark  
 EUMETSAT/Europe  
 EUTELSAT/Europe  
 FSST&CA/Belgium  
 HNSC/Greece  
 IKI/Russia  
 ISAS/Japan  
 ISRO/India  
 KARI/Korea  
 KFKI/Hungary  
 MOC/Israel  
 NOAA/USA  
 NSPO/Taipei  
 SSC/Sweden  
 TsNIIMash/Russia  
 USGS/USA

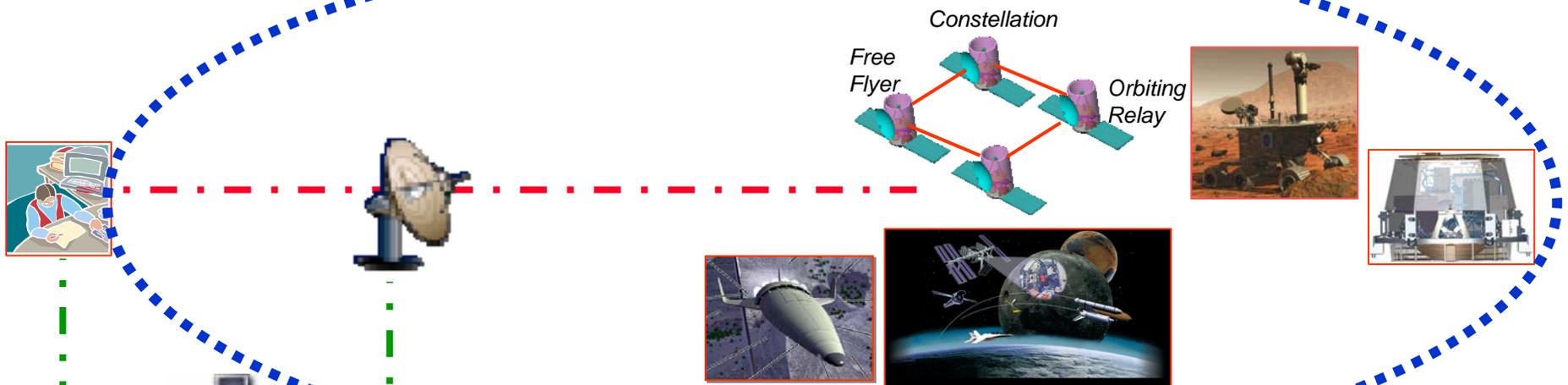
<http://www.ccsds.org>

# CCSDS Technical Context: Six Focus Areas



# Current CCSDS Technical Program of Work: 25 Standards under development





**Terrestrial Internet**

**Long-Haul Space Backbone**

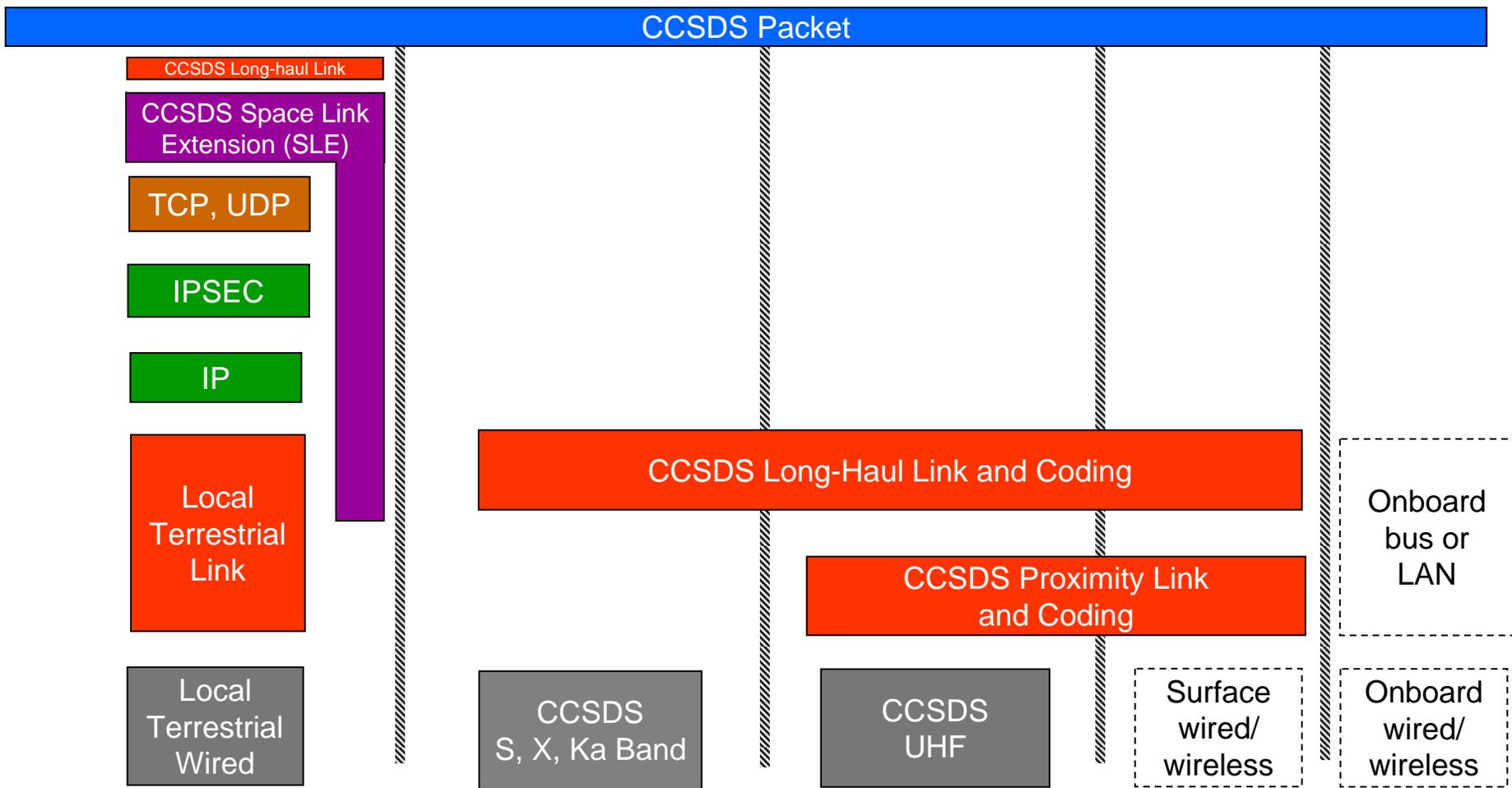
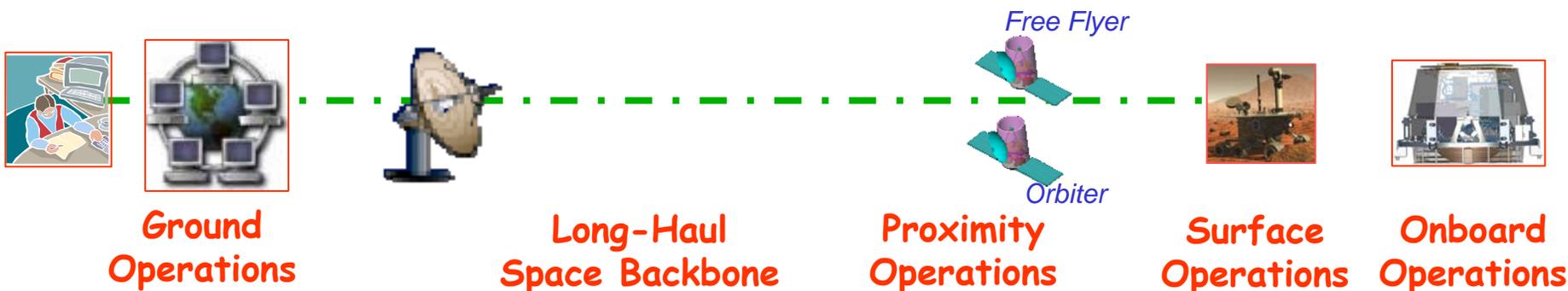
**Short-Haul Proximity Operations**

**Surface Operations**

**Spacecraft Onboard Operations**

**← End-to-end Internetworked Space Applications →**

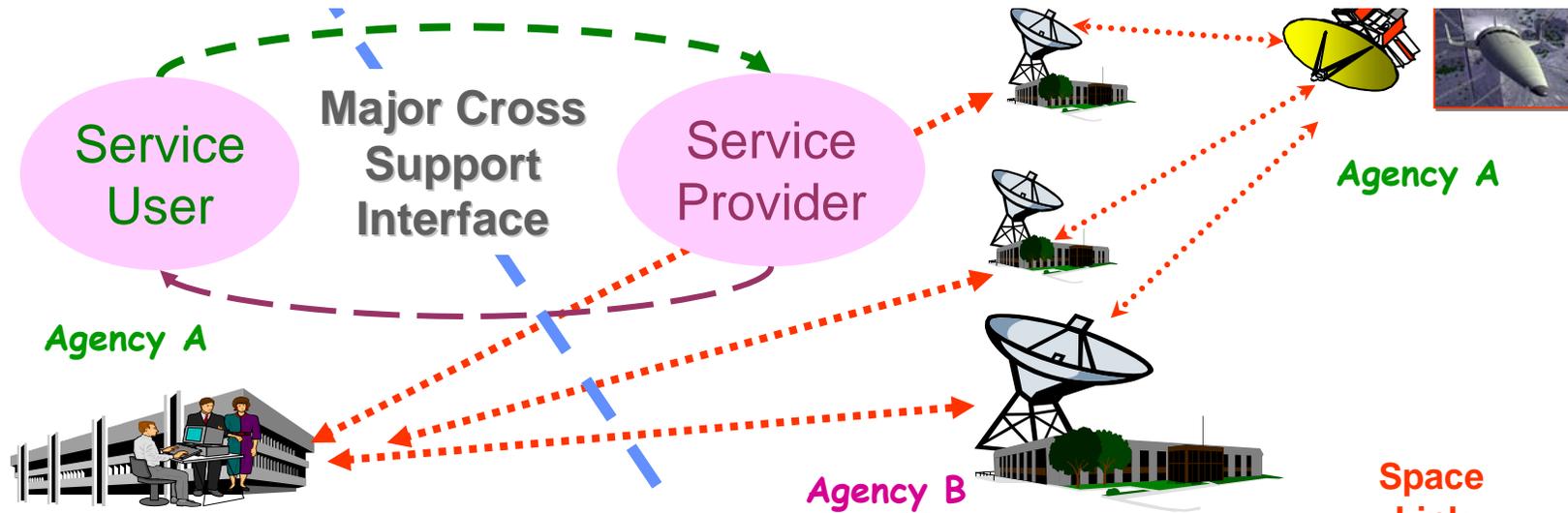
<p><b>Internet-based ground mission operations systems</b></p>	<p><b>Long delay near-Earth and deep space links</b></p>	<p><b>Short delay proximity links</b></p>	<p><b><i>in-situ</i> surface links</b></p>	<p><b>Spacecraft buses and LANS</b></p>
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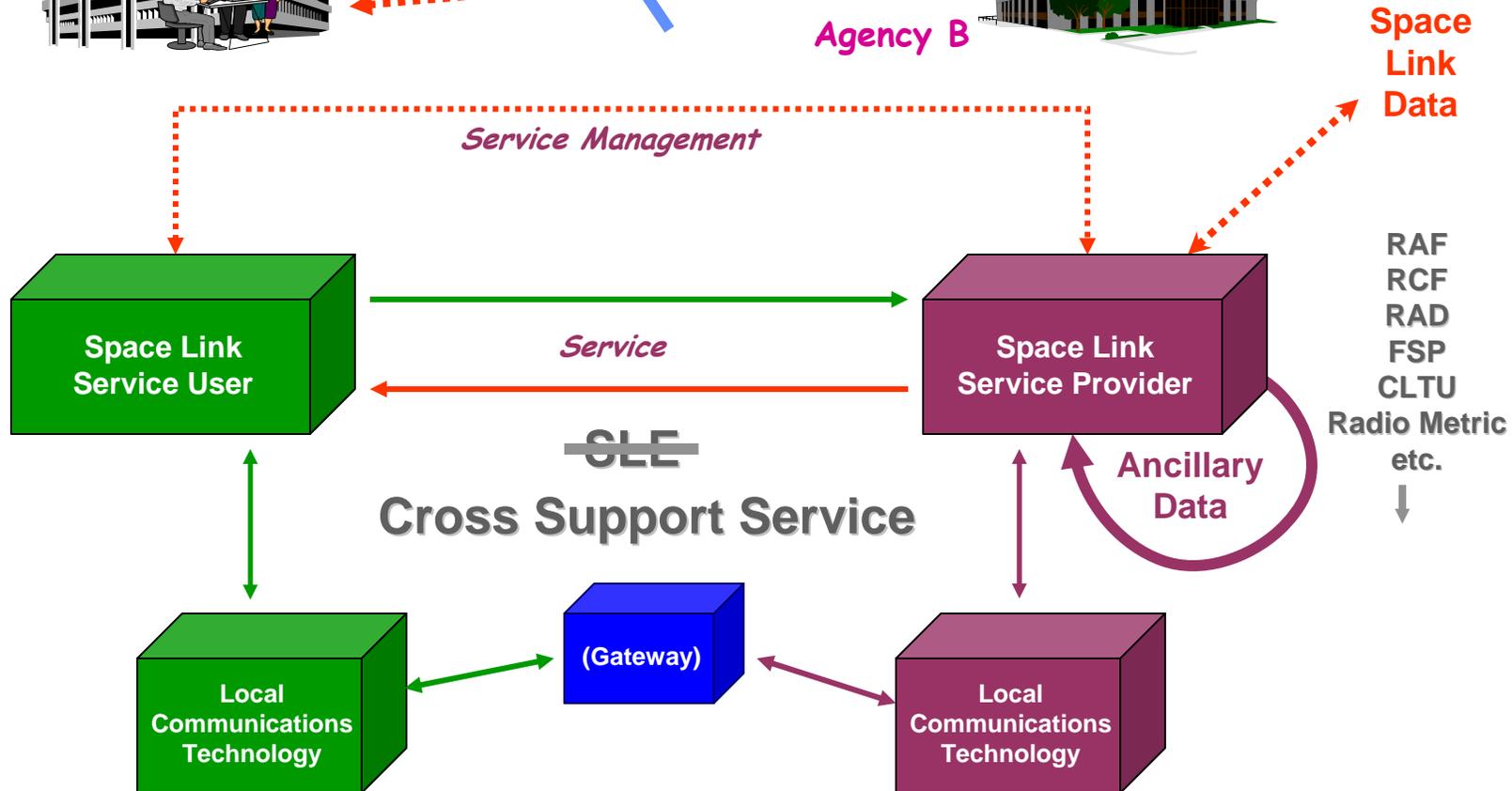
# Why SLE?

- “SLE” was not a new architectural capability that was introduced by CCSDS; it responded to a legacy space mission culture:
  - Namely, to keep ground stations “relatively dumb” and to focus mission-unique capability in the control center
    - It caters to the desires of projects to have “both ends of the space link” directly under their control
    - It supports an architecture whereby the control center become the “secure gateway” between the outside world and the space systems
- So “SLE” was initially designed to allow the space link to be “extended” beyond the ground station (by “tunneling” across the ground communications network) and terminated centrally. SLE simply *standardized* this dialog
- “SLE” is now being generalized to handle many types of ground station (service provider) ↔ control center (service user) information interchanges, including the management of the service provider/user interface

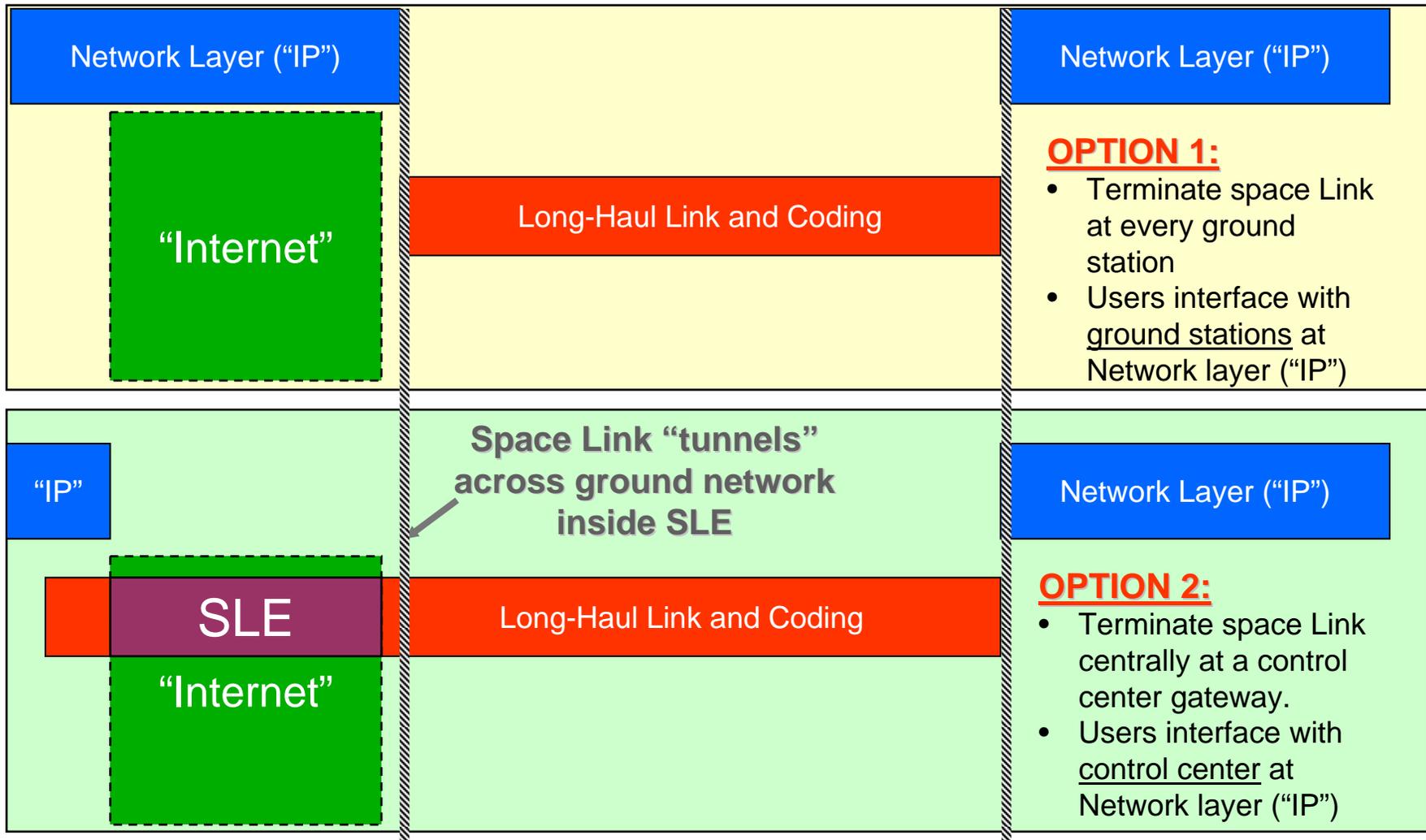


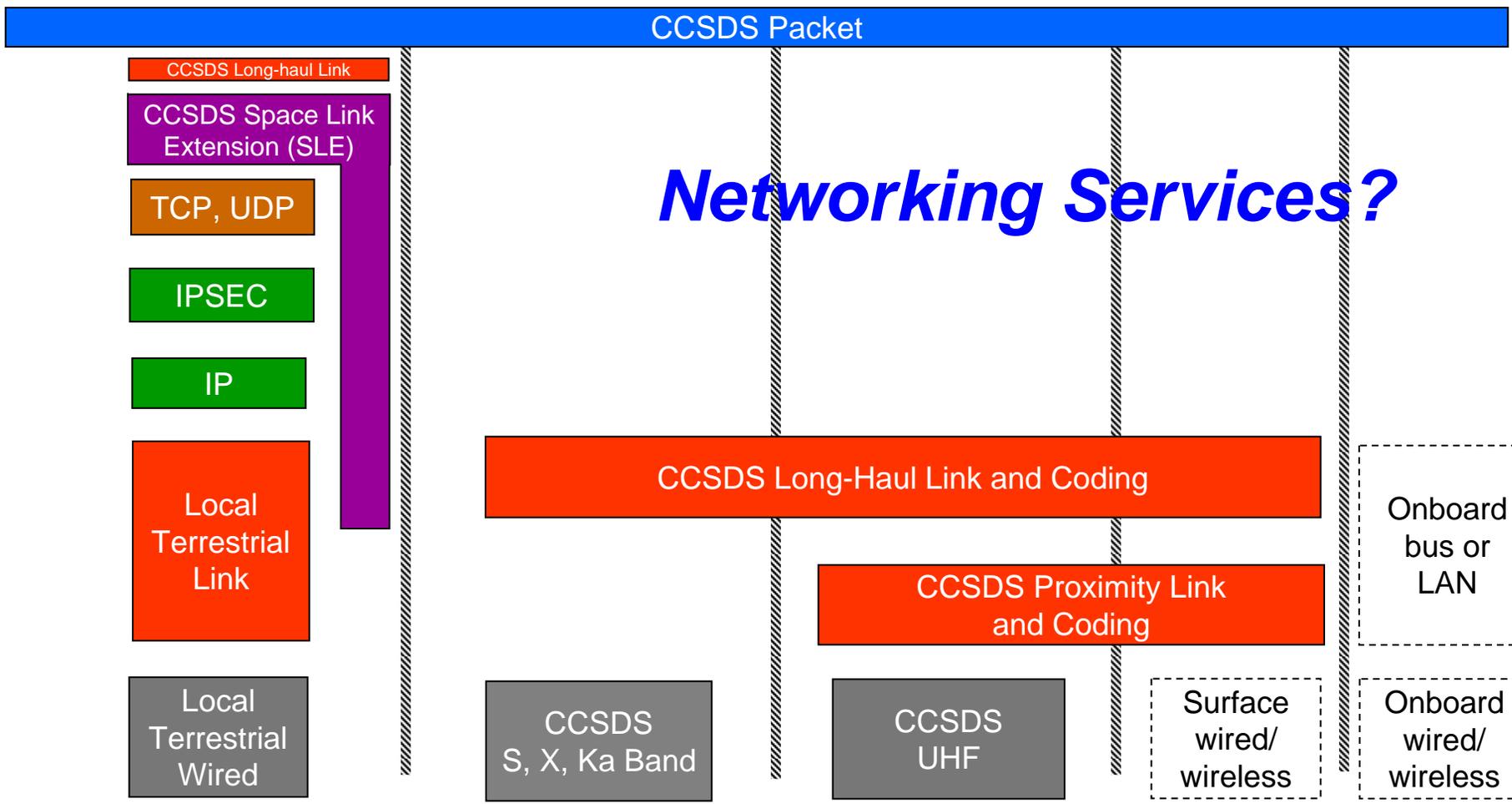


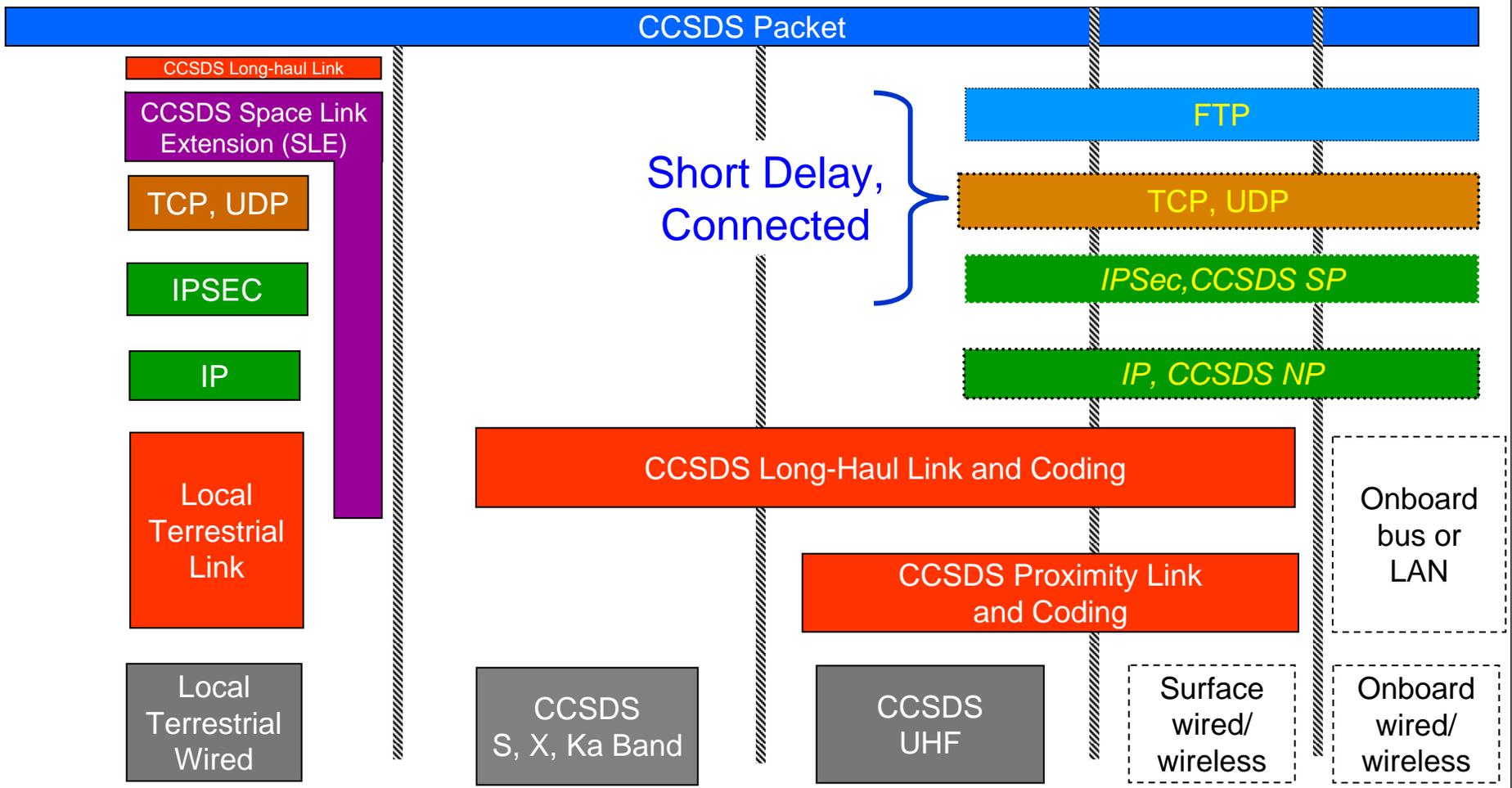
CROSS SUPPORT TRANSFER SERVICE MODEL



For space/ground data transfer, "SLE" responds to a significant architectural issue









**CCSDS Space Applications Services (CFDP, AMS, etc.)**

**CCSDS Packet**

CCSDS Long-haul Link

CCSDS Space Link Extension (SLE)

TCP, UDP

IPSEC

IP

Local Terrestrial Link

Local Terrestrial Wired

FTP

TCP, UDP

IPSec, CCSDS SP

IP, CCSDS NP

CCSDS Long-Haul Link and Coding

CCSDS Proximity Link and Coding

Onboard bus or LAN

CCSDS S, X, Ka Band

CCSDS UHF

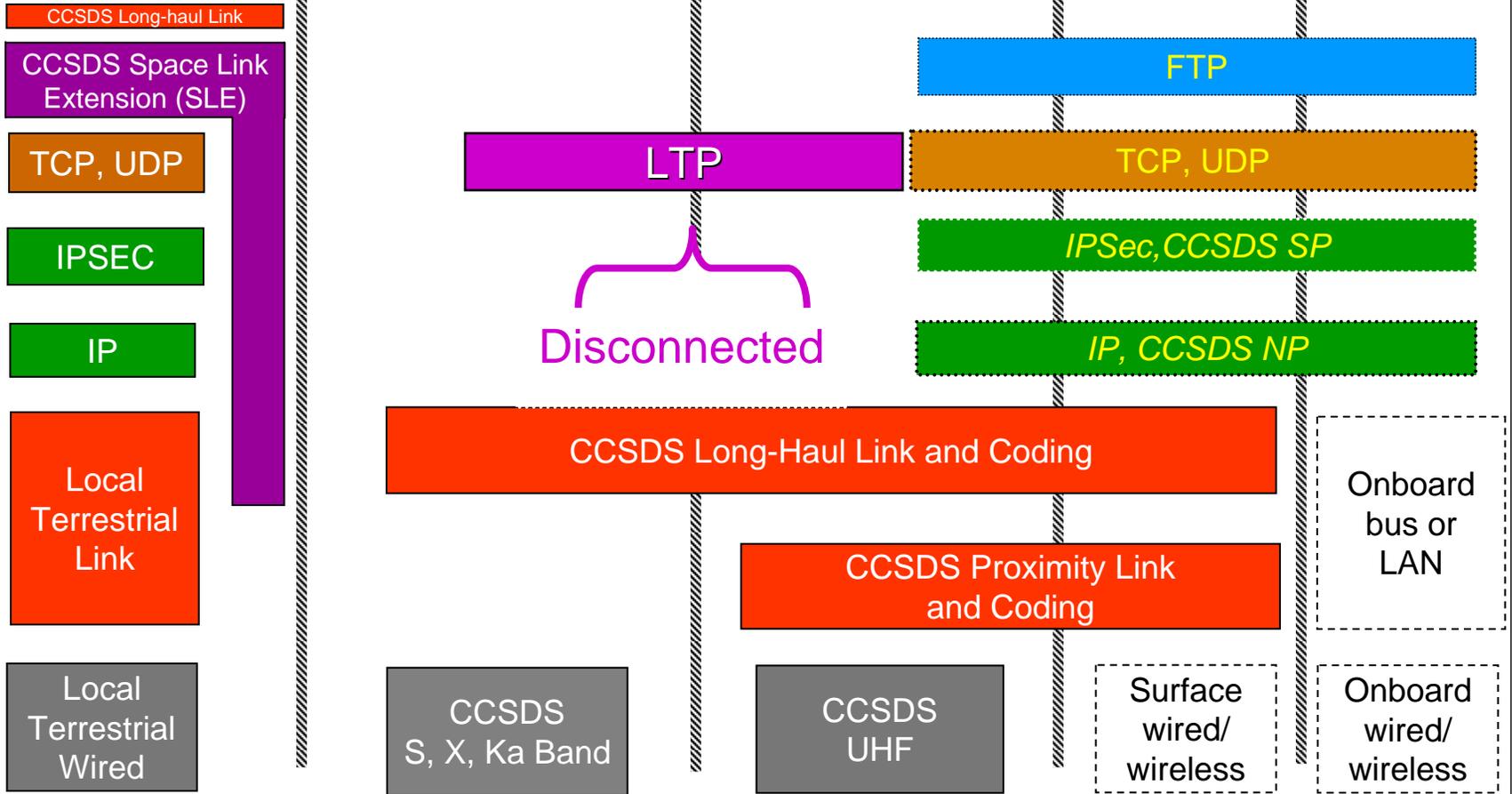
Surface wired/wireless

Onboard wired/wireless



**CCSDS Space Applications Services (CFDP, Messaging, etc.)**

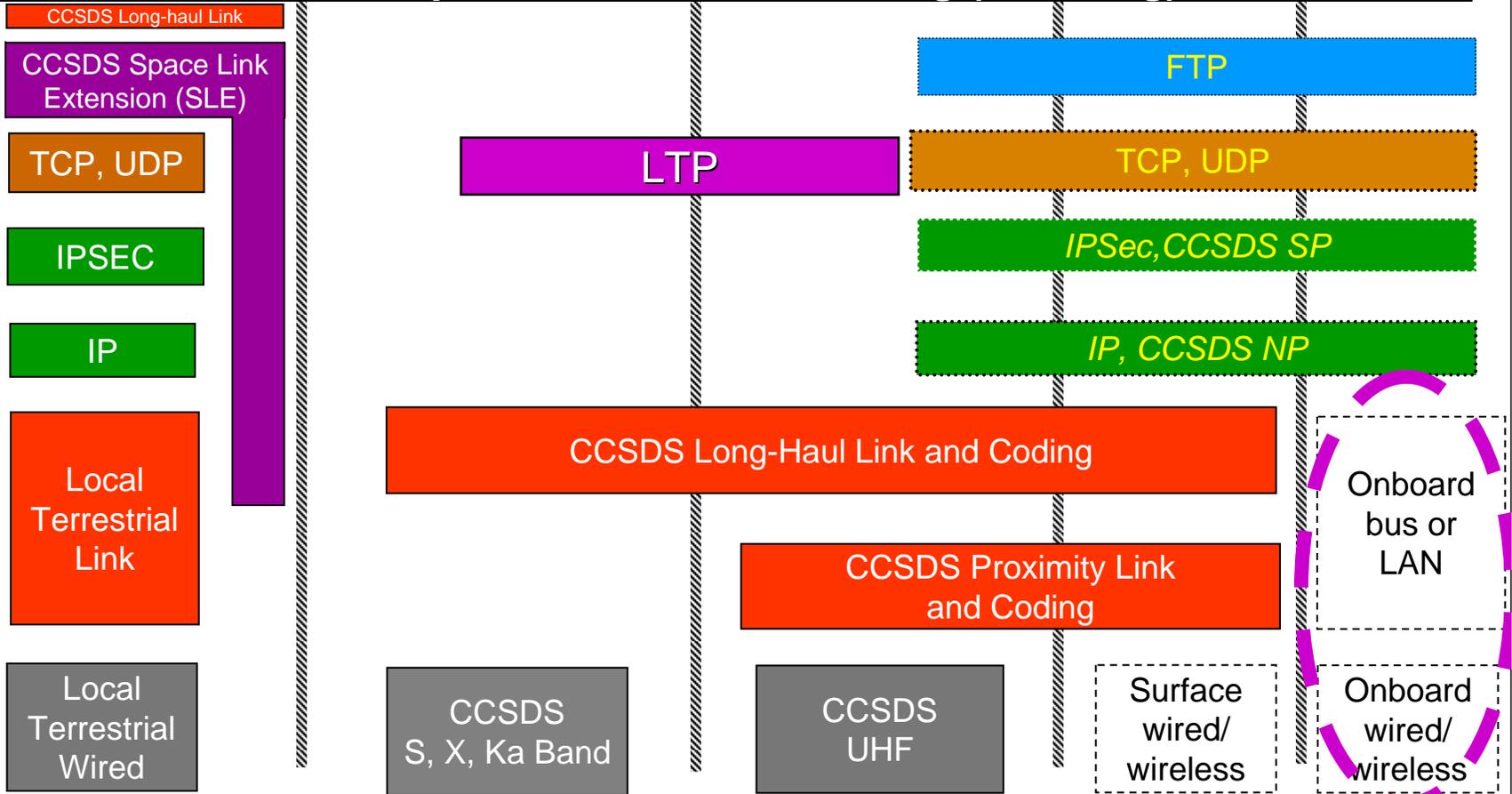
**CCSDS Disruption Tolerant Networking (Bundling)**



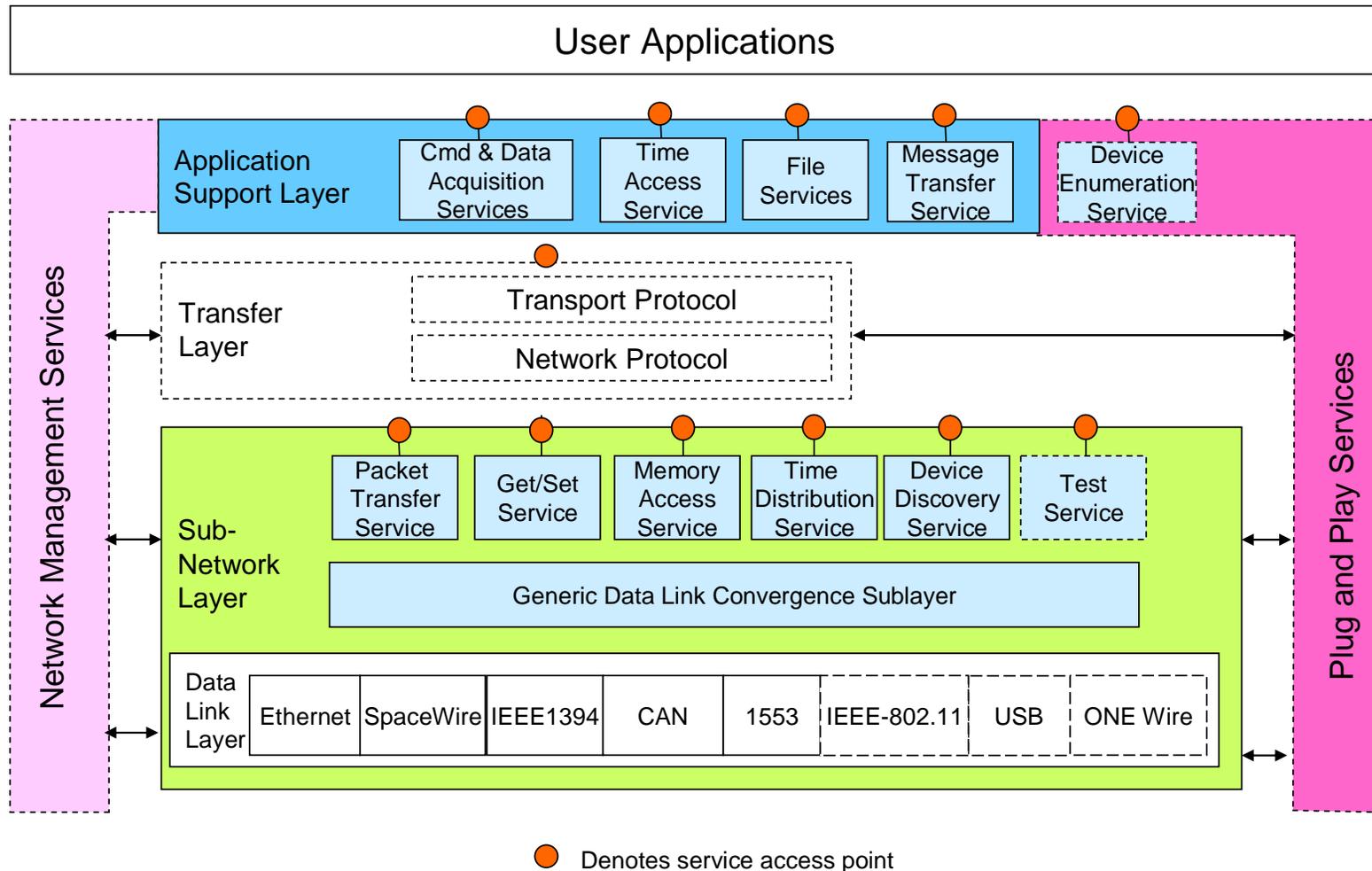


**CCSDS Space Applications Services (CFDP, Messaging, etc.)**

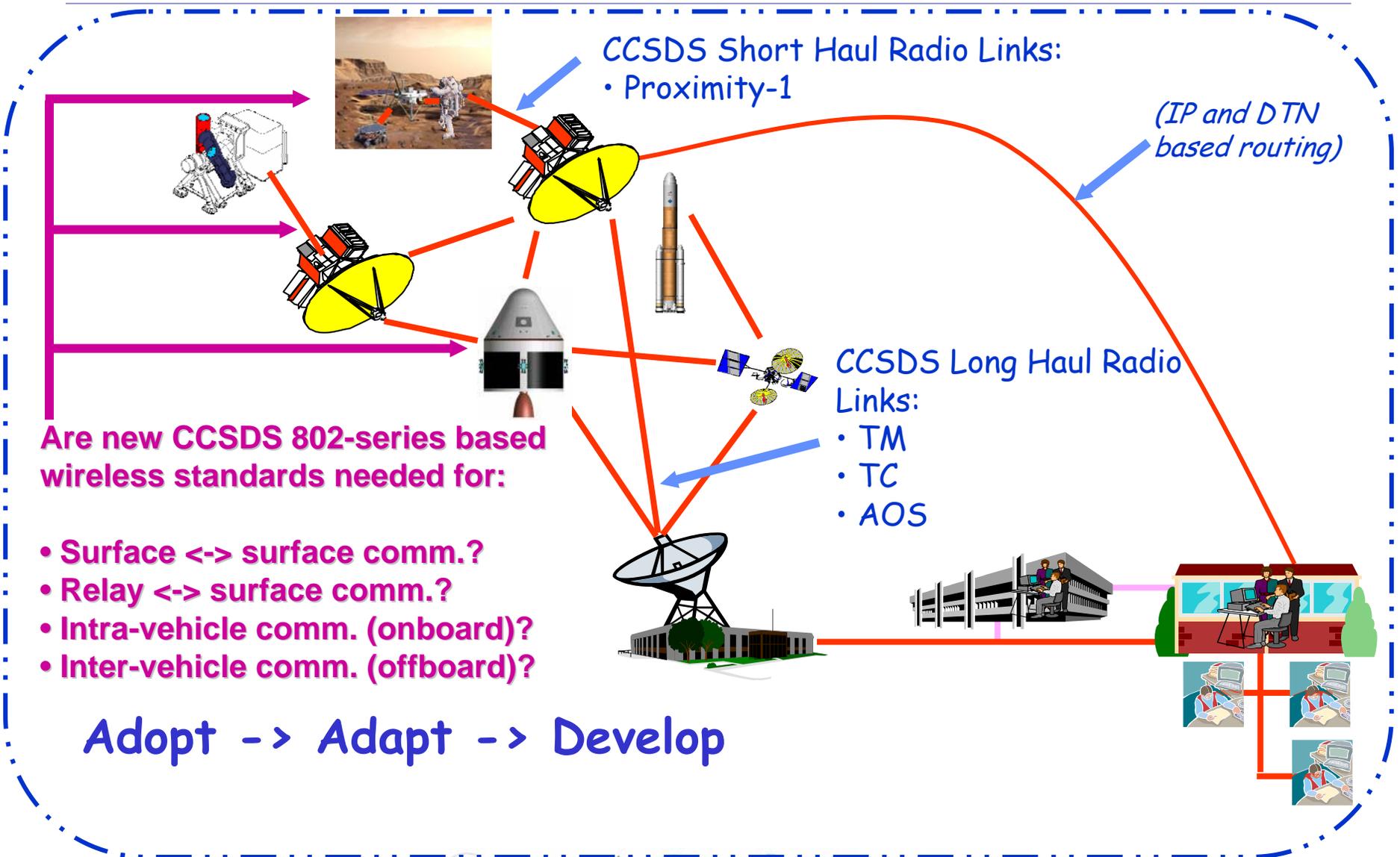
**CCSDS Disruption Tolerant Networking (Bundling)**



## SOIS Service Architecture



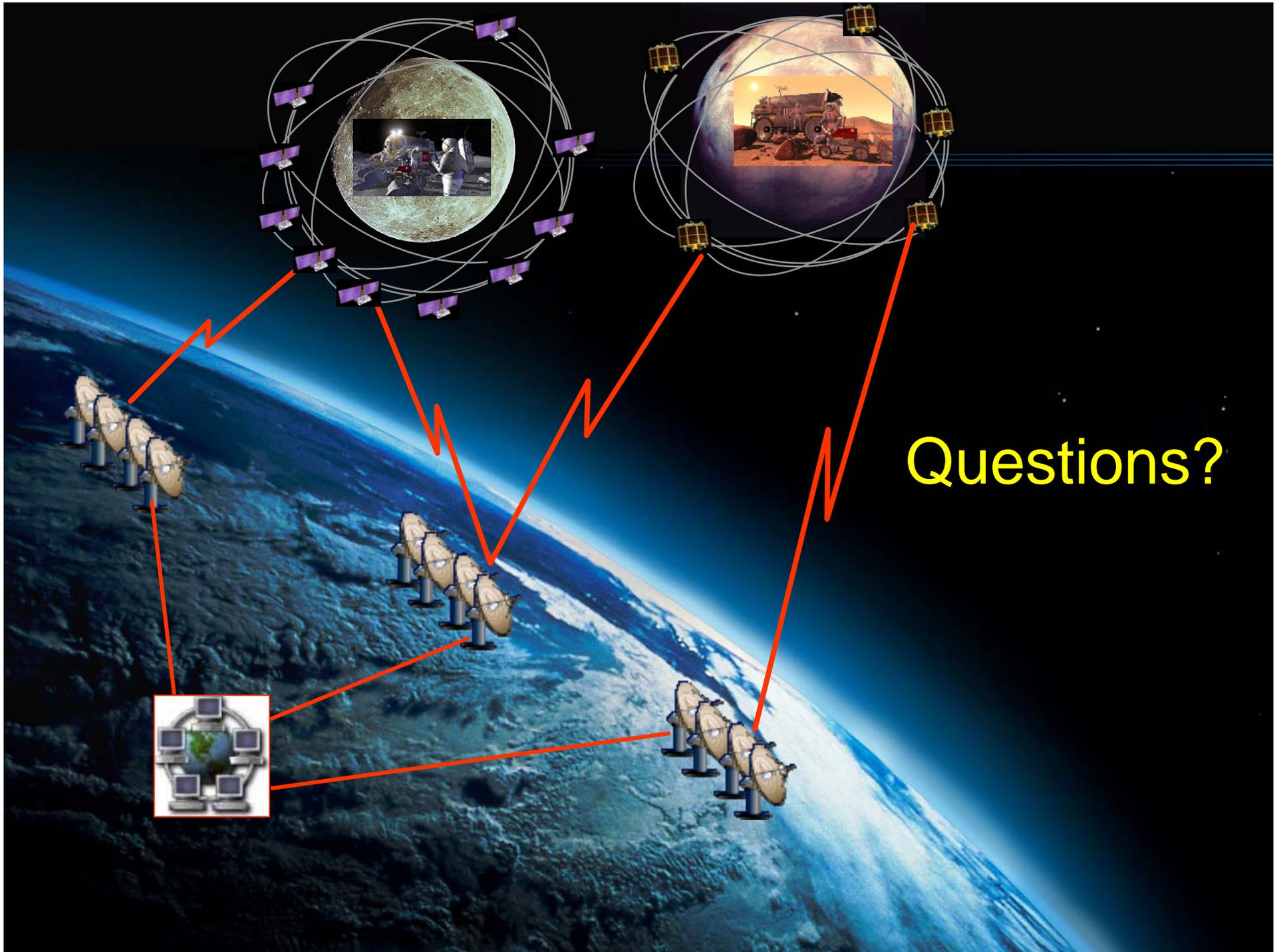
# Next Generation CCSDS Wireless Standards?



# Summary: CCSDS-related Developments To Be Watching

- **New networked architectures:**
  - **NASA Space Communications Architecture**
    - Lunar relays and surface communications
    - Mars relays and surface communications
    - Plug-and-Play spacecraft
    - Software defined communications terminals
    - Ground network consolidation, arraying
  - **NASA Exploration initiative**
    - Cislunar internetworking
- **New networking protocols:**
  - CFDP build-up
  - AMS
  - DTN
  - LTP
  - Onboard wired buses and LANs
  - Onboard, proximity and surface wireless





Questions?