Overview of Standards for Space Link Access

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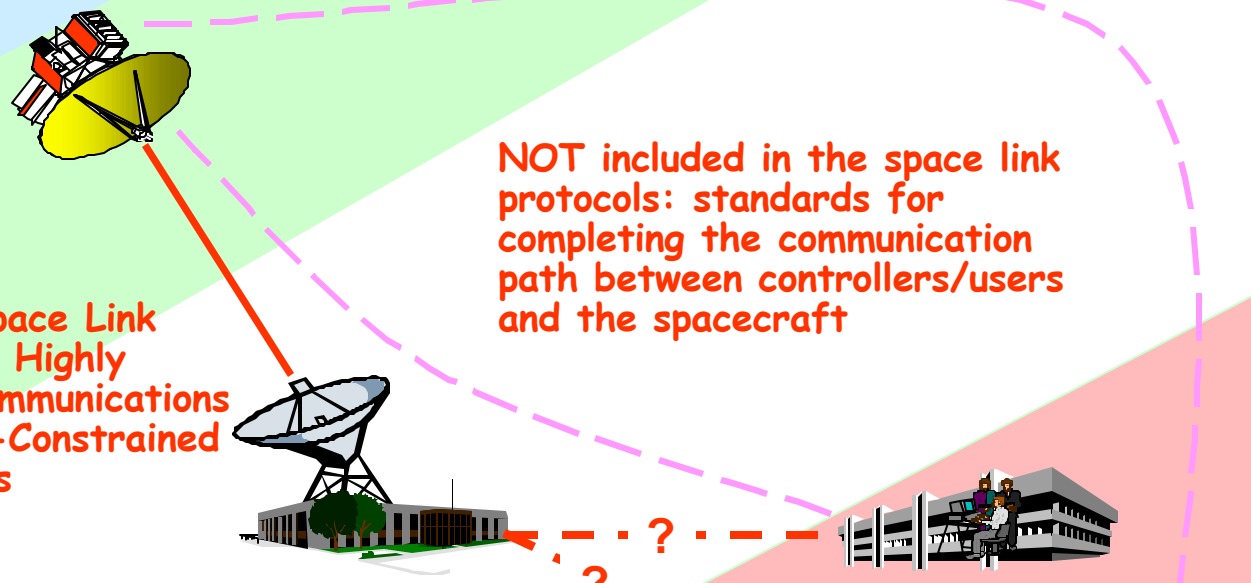
GSAW 2001
El Segundo, CA

22 February 2001

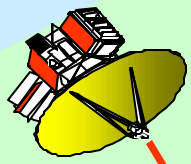
Space Link Access

Space Link Access: standardized capabilities for accessing spacecraft across both terrestrial networks and space-ground links to provide end-to-end connectivity



Legacy Approaches to Completing the End-to-End Link

Spaceflight missions "roll their own" ground services to transfer CCSDS space link data units to and from the ground termination of the space-ground link



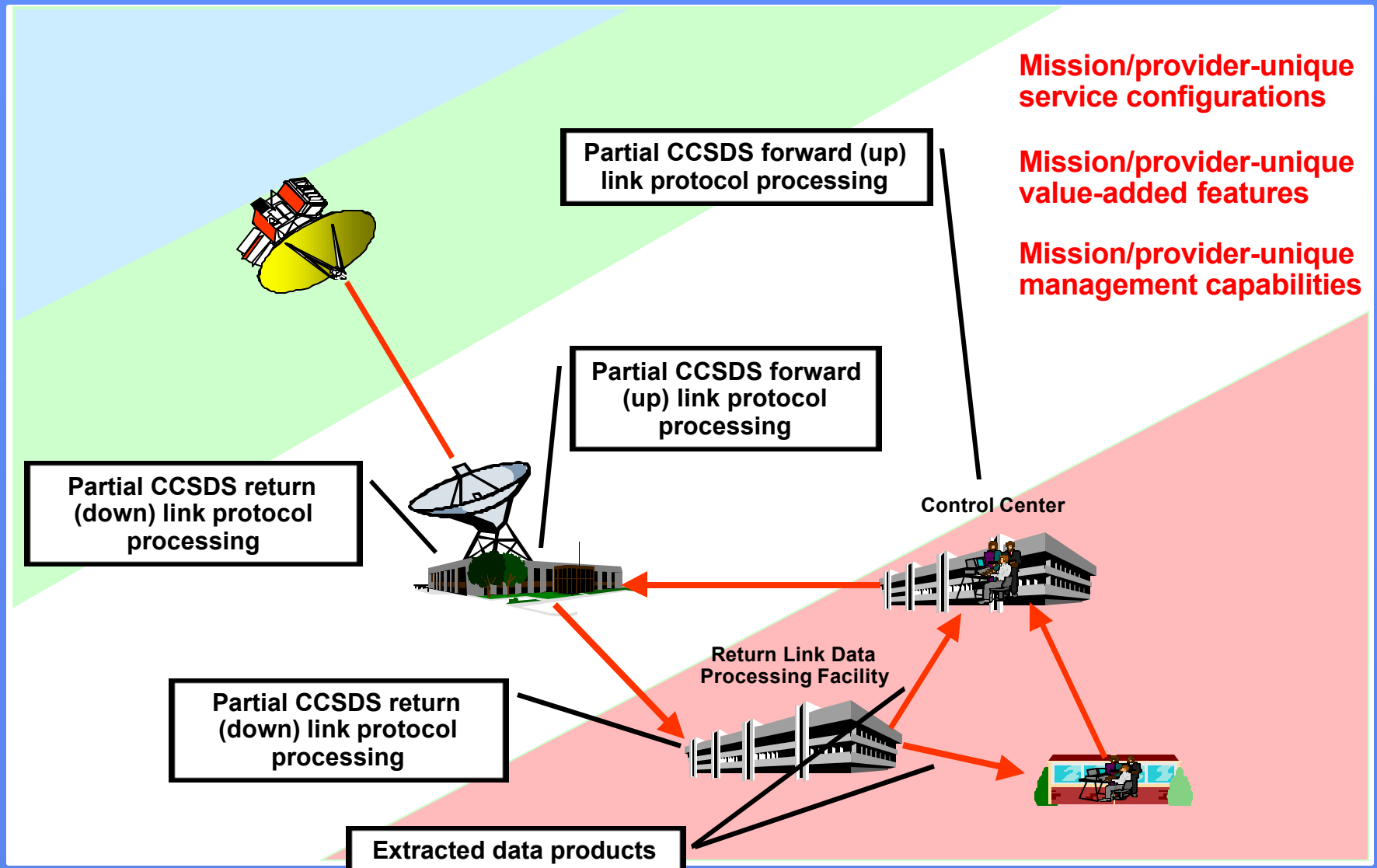
CCSDS Space Link protocols over terrestrial networks

Control Center

CCSDS Space Link protocols terminated in the control center

Mission-specific communication

Legacy Approaches to Completing the End-to-End Link (concluded)

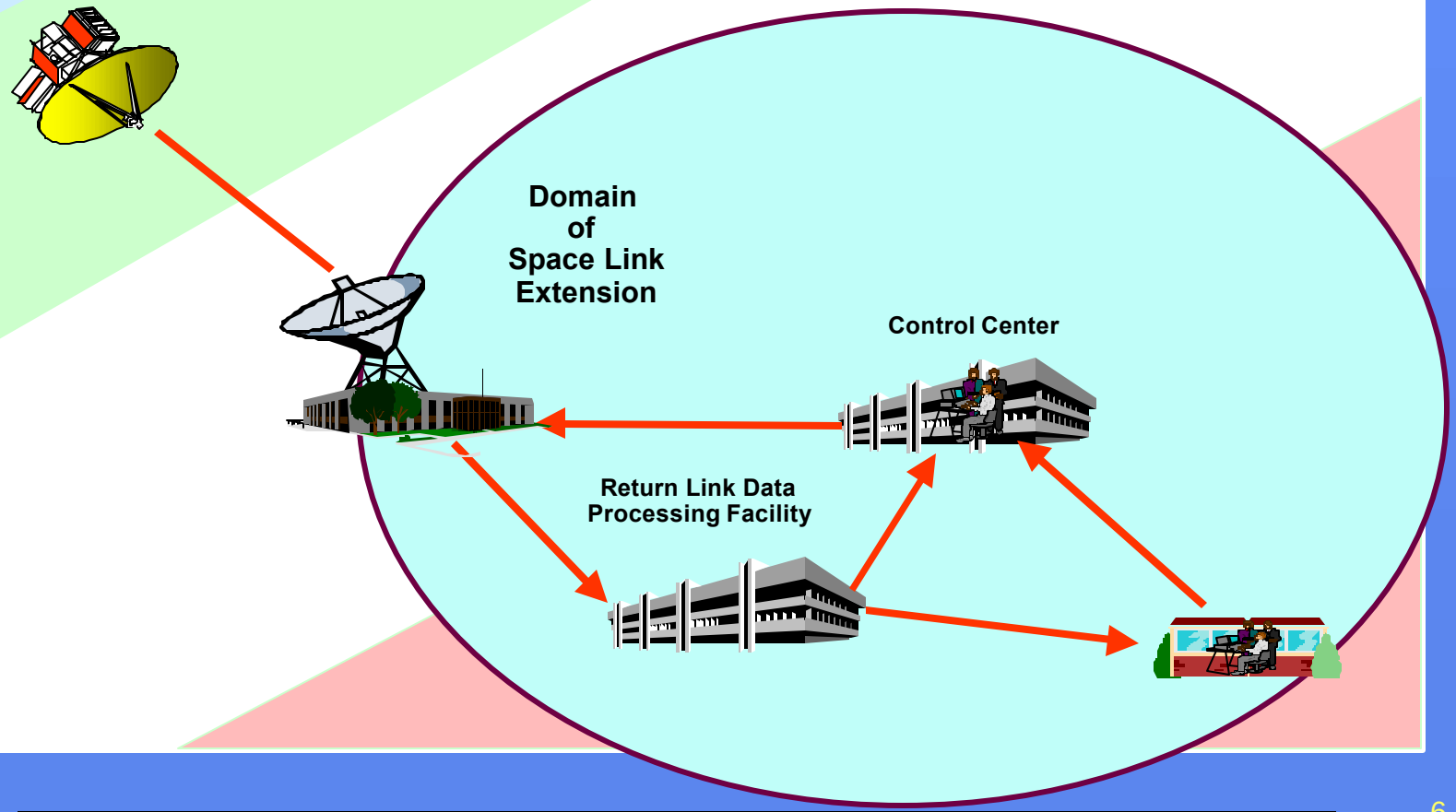


Standardizing Space Link Access

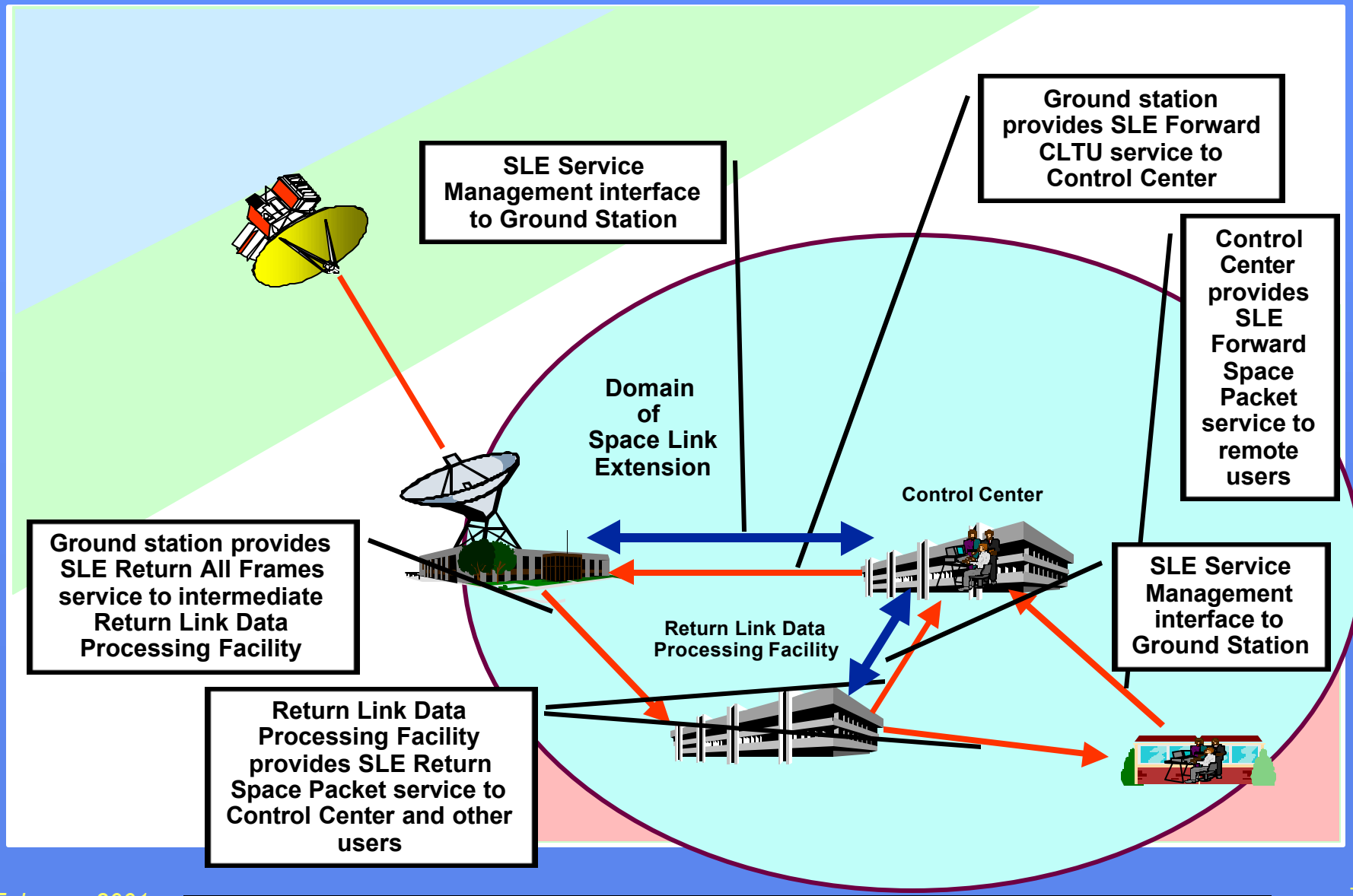
- Interoperability of ground resources is as important as interoperability of spacecraft and ground stations
- Space Link Access
  - Standard services and protocols for accessing spacecraft across terrestrial networks as well as the space-ground link
- Two stages to Space Link Access
  - Space Link Extension
  - Internet Access to Space

Space Link Extension

- **Standard services for exchanging CCSDS space link data units between ground termination of the space link and remote users**
  - Evolution of mission-unique/provider-unique services
  - Only requires that CCSDS link protocols be used on the space-ground link
  - Appropriate for missions that do not use Internet-interoperable protocols
  - Open framework for multiple access control and authentication mechanisms



Space Link Extension - *One* Example Configuration



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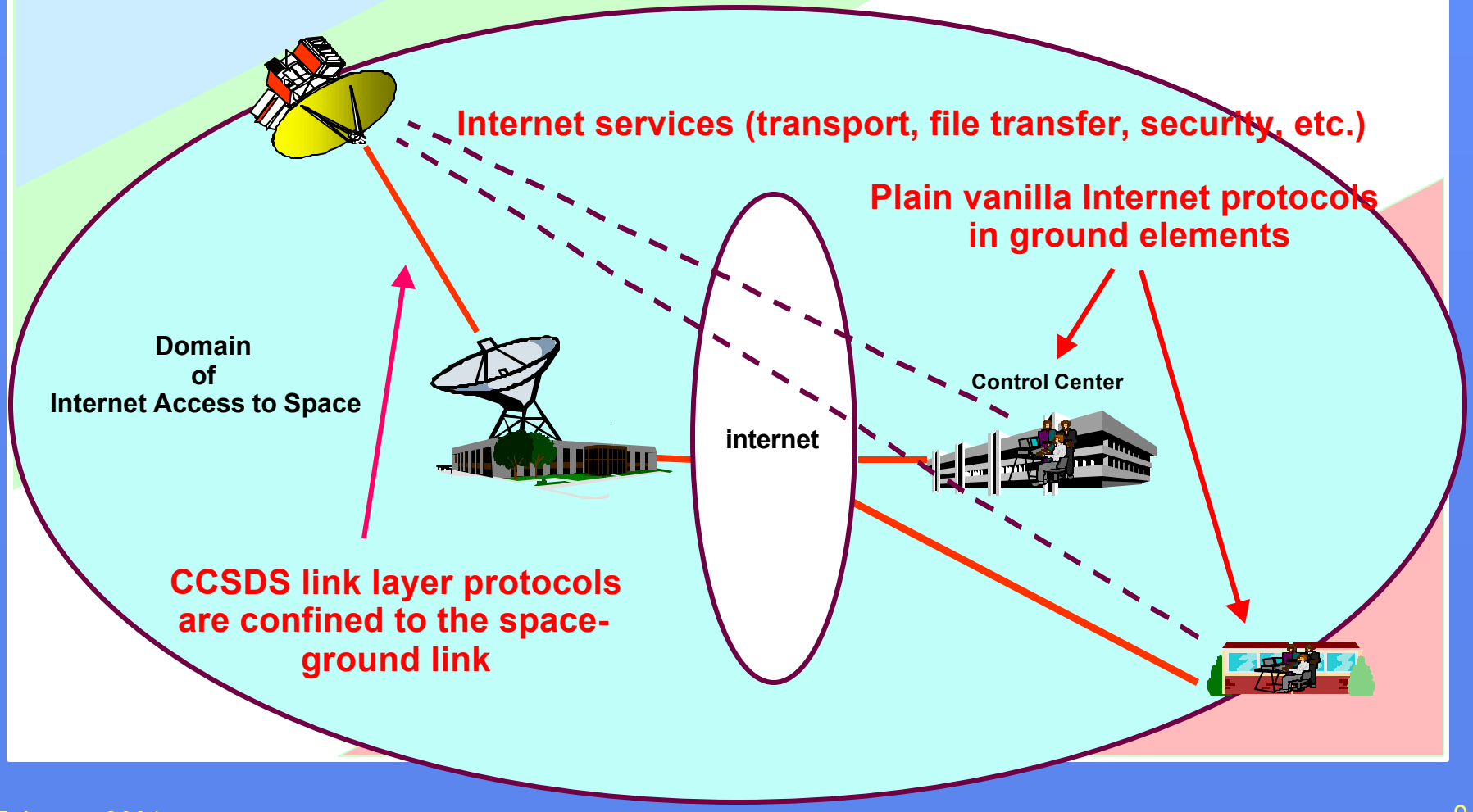
Internet Access to Space

**Don't bring the space link (protocols) to the user -
let the user access the spacecraft via Internet technology**



Internet Access to Space (concluded)

- Internet Access to Space does not necessarily mean running IP end-to-end across the space link
  - Several protocol architectures are under consideration
- Internet Access to Space involves much more than running network protocols, e.g.:
  - RF link scheduling
  - Network management
  - Dynamic routing
  - Provision of quality of service
- Near-term CCSDS support for Internet Access to Space: CCSDS space link protocols have been enhanced to carry IPv4, SCPS-NP, and IPv6, as well as CCSDS packets
- Longer-term CCSDS activity: integration of Internet Access to Space into the emerging SLE infrastructure

Backup Slides

Space Link Extension Transfer Services

- **Seventeen (17) SLE transfer services identified in SLE Reference Model**
  - **Ten (10) forward (uplink) services**
    - » Forward CLTU (Command Link Transmission Unit)
    - » Forward TC (Telecommand) Frame
    - » Forward TC-VCA (Virtual Channel Access)
    - » Forward Space Packet
    - » Forward proto-VCDU (Virtual Channel Data Unit)
    - » Forward Insert
    - » Forward C/VCDU ((Coded)/VCDU)
    - » Forward VCA
    - » Forward Bitstream
  - **Seven (7) return (downlink) services**
    - » Return All Frames
    - » Return Insert
    - » Return Channel Frames
    - » Return FSH (Frame Secondary Header)
    - » Return OPCF (Operations Control Field)
    - » Return Bitstream
    - » Return Space Packet

Status of SLE Transfer Service Standards as of February 2001

- **Core SLE transfer service specifications**
  - *Space Link Extension Forward CLTU Service Specification* (CCSDS 912.1): B-1 expected June 2001
  - *Space Link Extension Return All Frames Service Specification* (CCSDS 911.1): B-1 expected June 2001
  - *Space Link Extension Return Channel Frames Service Specification* (CCSDS 912.2): B-1 expected September 2001
  - *Space Link Extension Forward Space Packet Service Specification* (CCSDS 912.3): B-1 expected September 2001
- **JPL DSN has implemented Forward CLTU, Rerutn All Frames, and Return Channel Frames for the ESA Integral mission**
  - DSN operationally ready in Fall 2001 for April 2002 launch
- **Application Program Interface (API)**
  - JPL and ESA Unix-based implementations for Integral available
  - Avtec has implemented API (and Forward CLTU service) on Windows NT
  - On CCSDS standardization track
- **SLE transfer service-TCP/IP convergence specification**
  - Specification developed for Integral currently available
  - On CCSDS standardization track

Status of SLE Service Management Standards as of February 2001

- *Space Link Extension Service Management Specification* (CCSDS 910.5)
  - Specifies all SLE service management operations
  - Specifies all managed objects associated with processing and delivery of CCSDS space link data unit
  - Red Book version 2 projected for June 2001 review
- *Space Link Physical Layer Managed Object Specification* (CCSDS 910.7)
  - Specifies managed objects associated with the physical layer of the space-ground link (e.g., RF and modulation)
  - Red Book version 1 projected for June 2001 review
- *Authentication Managed Object Specification* (CCSDS 910.8)
  - Red Book version 1 projected for Fall 2001 review
- SLE Service Management Formal Specification
  - ISO GDMO specification of managed objects
  - CORBA IDL specification of management operations
  - Work begun: schedule to be set at June 2001 Panel 3 meeting