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End-to-End Networking BOF

Space Internet Workshop - 5

Sept 12-13, 2006

End-to-End Networking

- **End-to-end testing requires definition of detailed protocols in order to do actual testing**

- **Defining detailed network protocols requires definition of data flows and links to be supported**

- **Identifying data flows requires definition of operational capabilities to be supported**

- **So we started drawing some diagrams of all of the nodes and links we need to support**

CisLunar Comm Scenarios

TDRS

35 Km ?

3.5 Km

3.5 Km

.35 Km

36,000 Km

36,000 Km

355 Km

384,000 Km

3.5 Km

.35 Km

384,000 Km

250 Km

JSC

University

GSFC

Lunar size and distances not to scale

Actual Earth/Lunar scale

8/29/05

Lunar Comm Scenarios

Scenarios
  1 - Local comm, many to many
  2a - Mid-range comm, fixed relay (unmanned- data)
  2b - Mid-range comm, fixed relay (manned-audio,video,data)
  3 - Surface to surface via mobile relay
  4 - Long-haul comm, fixed nodes
  5 - Surface to long-haul mobile relay
Issues
  Many, ad-hoc, mobile links on surface and low-orbit
  Limited point-to-point links for long-haul
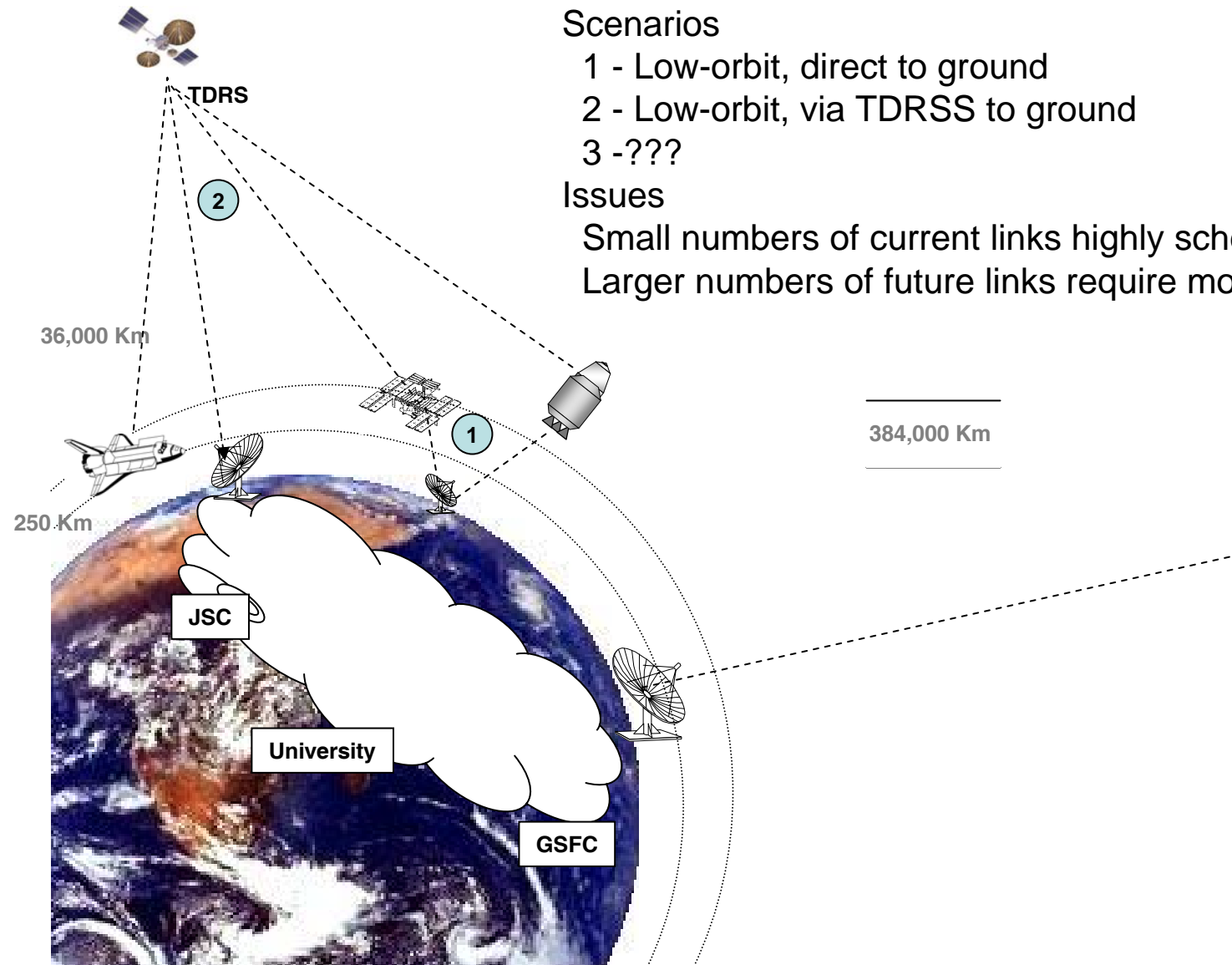 What types of data on each link (data, voice, video)

384,000 Km

4

5

3

2b

3.5 Km

1

.35 Km

2a
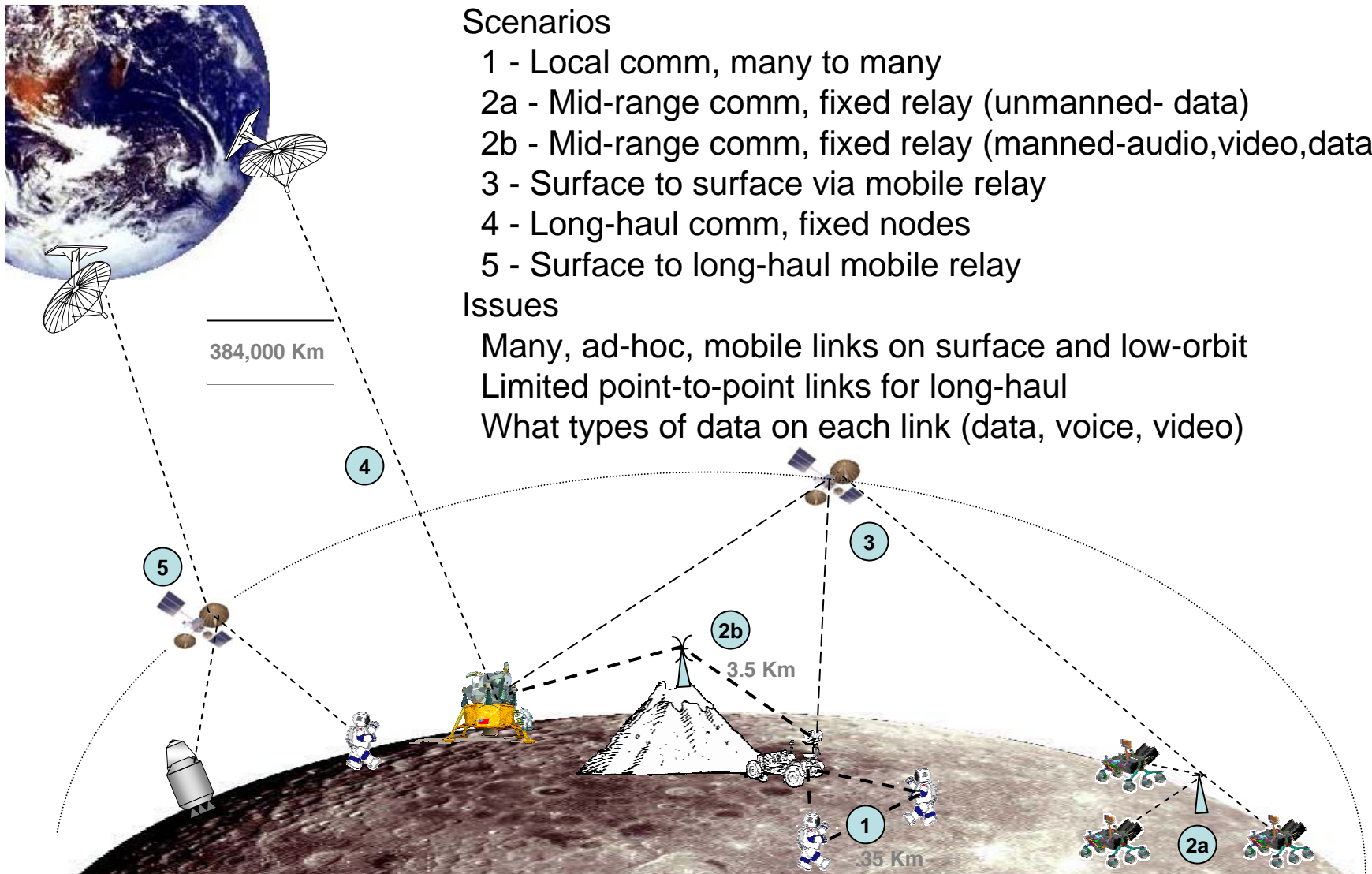
Earth-based Comm Scenarios

Scenarios
  1 - Low-orbit, direct to ground
  2 - Low-orbit, via TDRSS to ground
  3 -???
Issues
  Small numbers of current links highly scheduled/managed
  Larger numbers of future links require more automation

TDRS

36,000 Km

384,000 Km

2

1

250 Km

JSC

University

GSFC

Discussion Topics

- **Network Protocol Selection - IPv4 - IPv6**
  - IPv4 only for all future space systems
  - IPv4 & IPv6
  - IPv6 only for all future space systems
- **Network routing/mobility issues**
  - All links are intermittent
    - Some links managed with static routes (scheduled)
    - Some links semi-stable (stable for hours or more)
    - Some links highly mobile (stable for 5-10 minutes)
    - Some links mobile-to-mobile (neither end stationary, MANET)
- **Address allocation for Moon, Mars, etc.**
  - Should there be international subnet allocations for these

Network Protocol Selection - IPv4 - IPv6

- **IPv4 only for all future space systems**
  - Not much support for this approach
- **IPv4 & IPv6**
  - Support both IPv4 and IPv6 in future ground and space systems
- **IPv6 only**
  - Support only IPv6 for all future space systems
  - Support IPv4 & IPv6 on ground to connect space systems to ground networks
- **Selection issues**
  - Long-term operational differences?
  - Certifying and supporting code for different options?
  - Security and mobility support differences?