

Deepspace: Use Case and Architecture

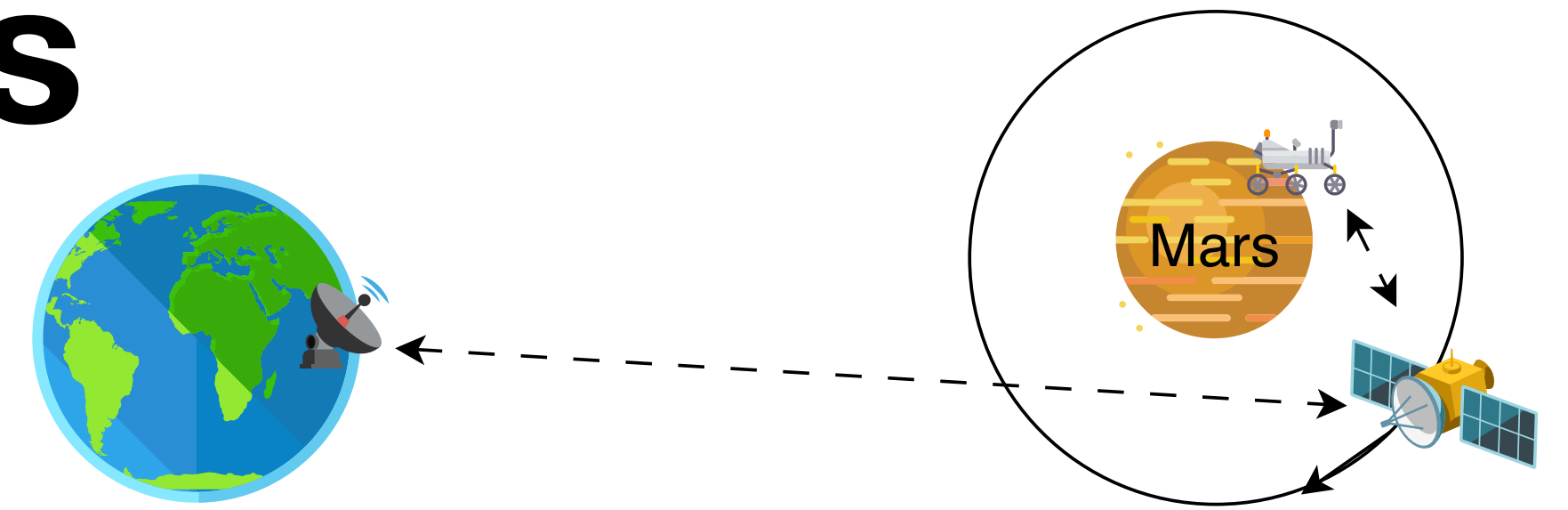
IETF 121 Deepspace BOF

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Use Case/Deployment Scenario

- On Celestial bodies surface and orbits:
 - connectivity as we know on Earth: 4-5-6G, Wifi, IEEE 802, RTT < 1s
 - Multiple providers, multiple customers
- Space links: (Earth-Moon, Earth-Mars,...)
 - Encapsulated in CCSDS space link frames
 - Long delays (i.e. Earth-Mars: RTT ~ 8-45 minutes)
 - Intermittent communications. Next slide

Intermittent Communications



- Example: orbiter acting as relay/forwarder on one side while the other peer is on the other side.
- Known in advance, can be planned, but a lot of variability in its actual usage (sometimes planned windows cannot be used)
- Therefore different communication windows between each neighbour: Earth-orbiter, orbiter-rover. Sometimes windows overlap, most often not.
- Consequence: need to store frames/packets on relays until the next communication window:
Can be done at:
 - L2 (as done today on Mars). In this case, L3 is unaware.
 - L3

Architecture/Key Considerations

- L2/L3 Storage* (and forward):
 - Need some buffer management and proper provisioning
- Transport:
 - UDP fine. ~~TCP~~
 - QUIC: two ways:
 - Set transport config parameters to worst case RTT* (aka including intermittence), so that transport is unaware of intermittence. Only flow control is used. Simulated and demonstrated for very large RTT (10 days!)*.
 - Or make transport aware of intermittence windows and do optimization: direct path vs non-direct path different behaviours

* => implemented/tested in simulation with very large RTT

Architecture/Key Considerations (cont.)

- Applications and Application Protocols*:
 - Set timers appropriately when relevant. For example, HTTP has no notion of time, but has some headers that are: set appropriately or do not use.
 - Applications implement asynchronous patterns
- Network Services:
 - DNS: avoid DNS resolution over deep space links RTT. Make sure that all names (and key material+trust chain) needed remotely are pre-fetched/pushed/cached.

Architecture/Key Considerations (cont.)

- Deployment:
 - may use transport proxies/ALGs at space edges.
- Timeline: Moon: “soon”, Mars: “later”