Space-Based Wireless Network Protocol Stack Supporting MAC-Level Dynamic Resource Allocation for Real-Time Prioritized Data Classes

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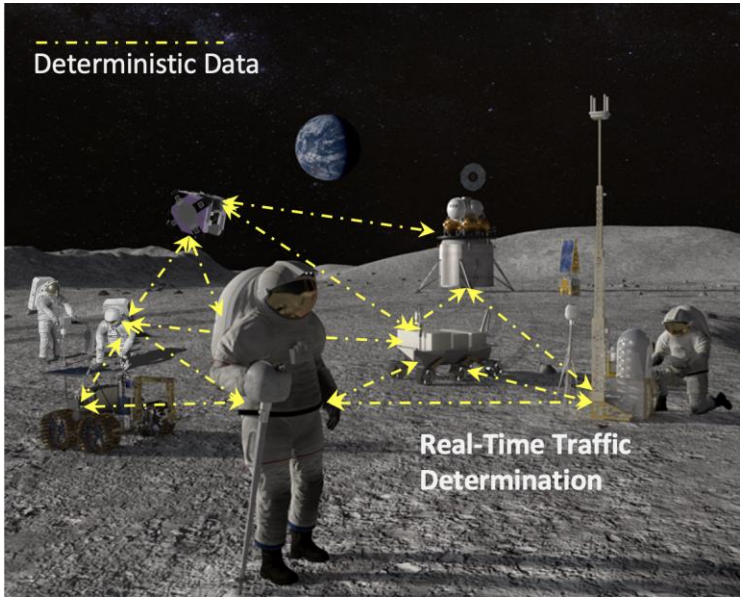
Research Objectives

- *Develop* a novel wireless technology for spaceflight environment that is adaptable for a variety of uses
- *Implement* a protocol stack to simultaneously prioritize three distinct classes of traffic
  - **Real-Time Deterministic** traffic (latency <100µs, jitter < 10µs, BW > 20 Mbps)
  - **High-Rate Deterministic** traffic (latency <4ms, jitter < 200µs, BW > 100 Mbps)
  - **High Data Rate** traffic (BW > 500 Mbps)
- *Verify* the theoretical limits of this wireless technology in simulation, and its practical limits in the laboratory and in analog environments.



Approach

- Begin with effective simulation tools to validate critical system components, including
  - Protocol stack
  - Verification of performance for various deterministic classes
  - Enhanced MAC layer
  - Robust Physical layer
- Implement the proposed system using appropriate hardware platforms
  - Wifi-based FPGA system
  - Test-bed to validate performance criterion to include parameters such as *data rate*, *jitter*, *latency*, and *scalability*

Potential Impact

A wireless network system that can support different QoS will be helpful in missions that include human and autonomous components. Adaptable communication based on deterministic needs will help with

- Reduced spacecraft *mass*, *size*, and *complexity* through reduced cabling requirements
- *Adaptable connectivity* between spacecraft and non-human mission elements
- *Redundancy* between spacecraft components and non-human mission elements
- Spacecraft *hardening* against mechanical failures