

Slide 6

- **Network & Physical Layer**

- ● Bundle protocol with unique IDs, TTL, and expiration handling
- ● RF link modeling: SNR, path loss, Ka/Ku-band profiles, weather attenuation
- ● Contact capacity derived from data rate \times window duration

- **Routing Algorithms**

- ● Epidemic (flood replication), PROPHET (probabilistic), Spray-and-Wait (copy-limited)

- **Buffer Management**

- ● Configurable sizes per node; drop policies: oldest-first, largest-first, random

- **Orbital Mechanics**

- ● Keplerian propagation with ECI/ECEF conversion
- ● Contact window prediction via satellite-ground visibility calculations

Slide 7

- **3D Interactive GUI**

- ● Real-time satellite constellation on rotating Earth
- ● Animated packet transfers (pulsing arcs on active links)
- ● Contact Gantt charts and per-node buffer utilization bars
- ● Ground station markers, run controls (start/stop/pause, time acceleration)

- **Live Metrics**

- ● Delivery ratio, throughput, buffer utilization

- **Experiment Framework**

- ●E1: Protocol comparison | E2: Buffer size sweeps | E3: TTL configuration
- ●Preset endpoints for reproducible experiments